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ENVIRONMENTAL ANALYSIS AND TECHNICAL REPORT ON PROPOSED GEOTHERMAL LEASING IN THE KILBOURNE HOLE AREA

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

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ENVIRONMENTAL ANALYSIS AND TECHNICAL REPORT ON PROPOSED GEOTHERMAL LEASING IN THE KILBOURNE HOLE AREA

PLANNING UNIT 03-03
LAS CRUCES-LORDSBURG RESOURCE AREA
LAS CRUCES DISTRICT

April 9, 1975

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INTRODUCTION

The natural heat energy of the earth's interior is called geothermal energy. The intense heat of the earth's interior is thought to have accumulated for billions of years within the interior of the earth as the result of decaying radioactive elements such as uranium and thorium, from the frictional dissipation of energy released by the gradual segregation by density of materials, and probably by the deformation of mantle rocks*(21) (Illustration 1).

Geothermal energy is presently known to occur in four basic forms or systems: vapor-dominated system, hot water system, hot dry rock system, and geopressured reservoir system.

The vapor dominated system, or more commonly referred to as a "dry steam" system, is thought to have very limited occurrence throughout the world. At this time the only commercial geothermal field in the United States is a dry steam system located at the Geysers in northern California. Although this field is still undergoing development, production began in 1960. Over 100 wells have been drilled and approximately 400 Mw of electricity are being produced. (One megawatt of electricity supplies the needs of about 1,000 people). Other commercial dry steam fields are located at Larderello, Italy and Matsukawa, Japan.

Dry steam production has several desirable characteristics such as: direct use of the steam to drive the turbines, limited quantities of waste requiring disposal, and low mineral content resulting in less corrosion and scaling of equipment. Considering the environment, technology, and economics, the dry steam system is the most desirable at this time.

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* Number in ( ) refers to literature cited.

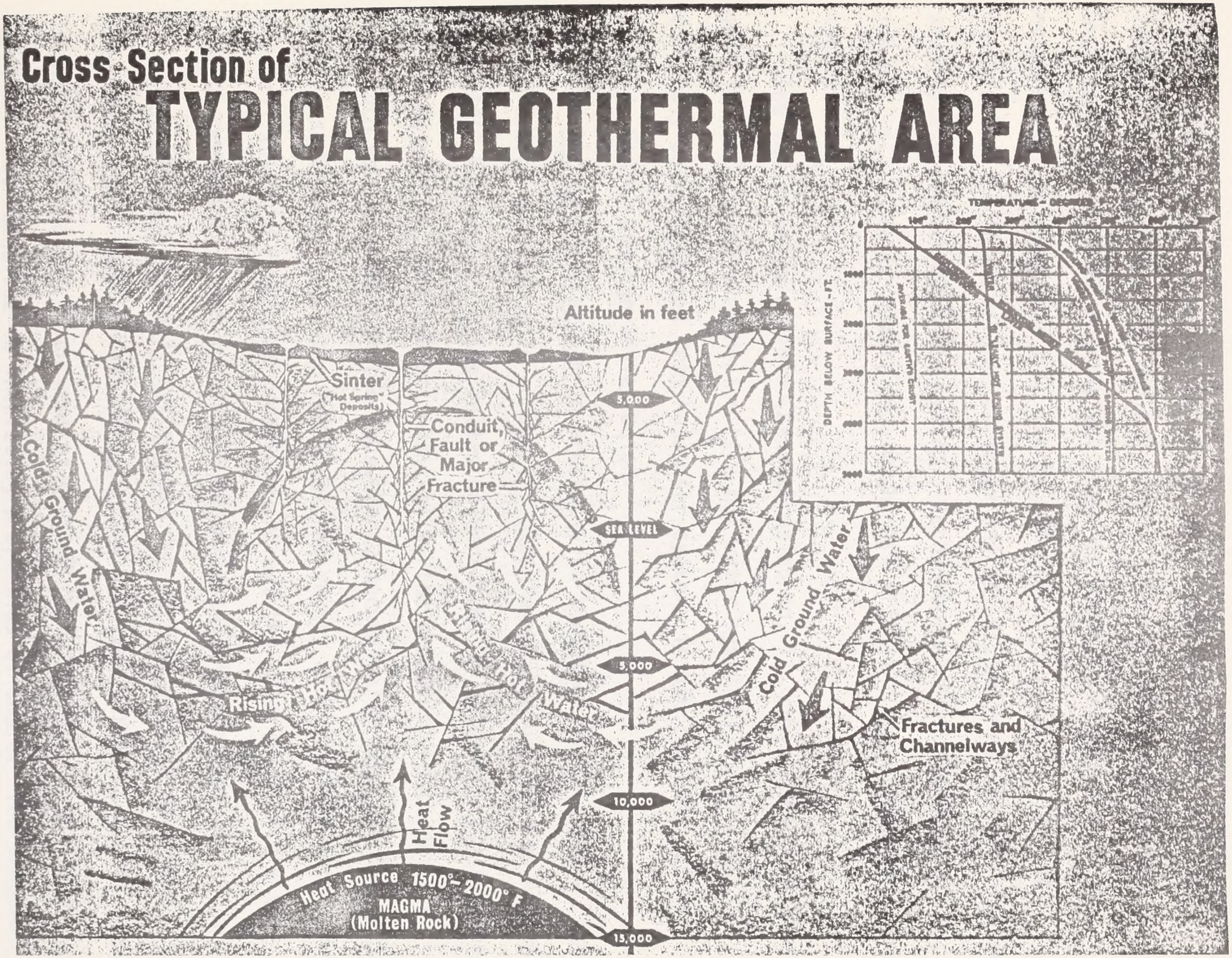


ILLUSTRATION 1

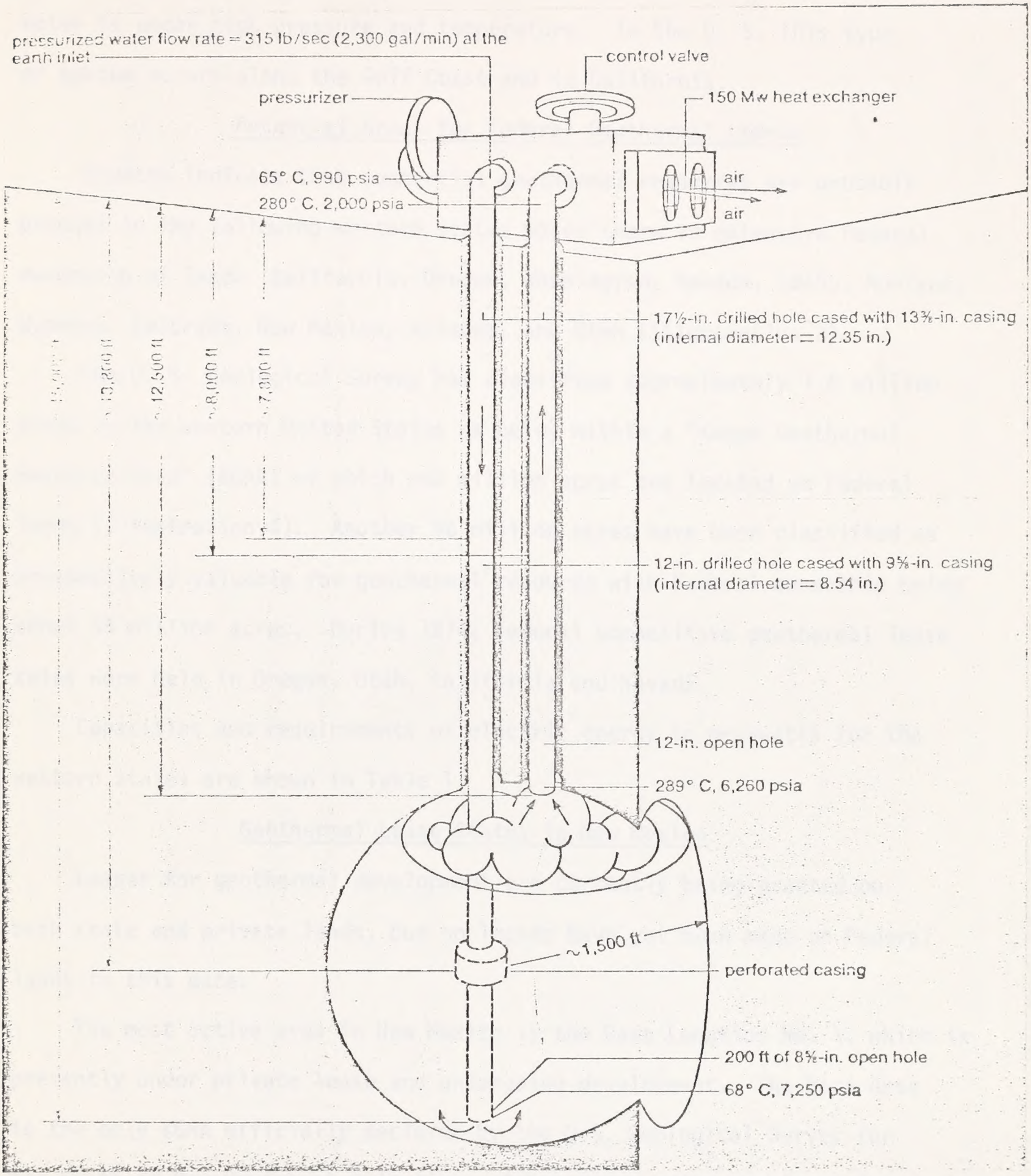
TAKEN FROM FINAL ENVIRONMENTAL STATEMENT FOR GEOTHERMAL LEASING PROGRAM, 1973

Present indications are that the hot water system is much more common in occurrence than the dry steam. With this system, the pressure drop which occurs as the water rises in the well causes the water to flash (separate) into both steam and hot water. After flashing, the steam is used to drive turbines and the hot water is disposed of by reinjection, evaporation, or discharge into nearby waterways. Corrosion, scaling, and disposal of large volumes of water and associated minerals are problems usually associated with this system. Technological advancements, in the future, will no doubt result in a much more efficient use of the hot water system.

The Valles Caldera Field (Baca Location No. 1), currently under development in northcentral New Mexico is a hot water system. Electricity is currently being produced from hot water systems in New Zealand, Japan, Iceland, Mexico and the Soviet Union.

The hot dry rock system is presently in the experimental stage. The Atomic Energy Commission is conducting experiments through the Los Alamos Scientific Laboratory in the Valles Caldera Area to determine the feasibility of developing this system. Basically, the principal is to drill a well into hot dry rocks in the subsurface, mechanically fracture the rocks, drill a second well into the fractured hot rocks, and circulate water down one well into the fractured reservoir and out the other well into a turbine or generating plant to produce electricity (Illustration 2).

Geopressured reservoir systems are not currently being developed and may be years away due to technological problems. This system is located in sedimentary basins in an area of crustal thinning, where heat flow has been restricted due to insulating properties of shale. The trapped


pressurized water flow rate = 315 lb/sec (2,300 gal/min) at the earth inlet
control valve
pressurizer
150 Mw heat exchanger
65° C, 990 psia
280° C, 2,000 psia
air
air
~13,800 ft
~12,500 ft
~8,000 ft
~7,300 ft
17½-in. drilled hole cased with 13⅜-in. casing (internal diameter = 12.35 in.)
12-in. drilled hole cased with 9⅝-in. casing (internal diameter = 8.54 in.)
12-in. open hole
289° C, 6,260 psia
~1,500 ft
perforated casing
200 ft of 8⅝-in. open hole
68° C, 7,250 psia

Taken from Britannica's 1975 Yearbook of Science and the Future.

DRY ROCK SYSTEM

ILLUSTRATION 2

water is under high pressure and temperature. In the U. S. this type of system occurs along the Gulf Coast and in California.

Potential Areas for Federal Geothermal Leases

Studies indicate that commercial geothermal resources are probably present in the following western states where there is extensive Federal ownership of land: California, Oregon, Washington, Nevada, Idaho, Montana, Wyoming, Colorado, New Mexico, Arizona, and Utah (Illustration 3).

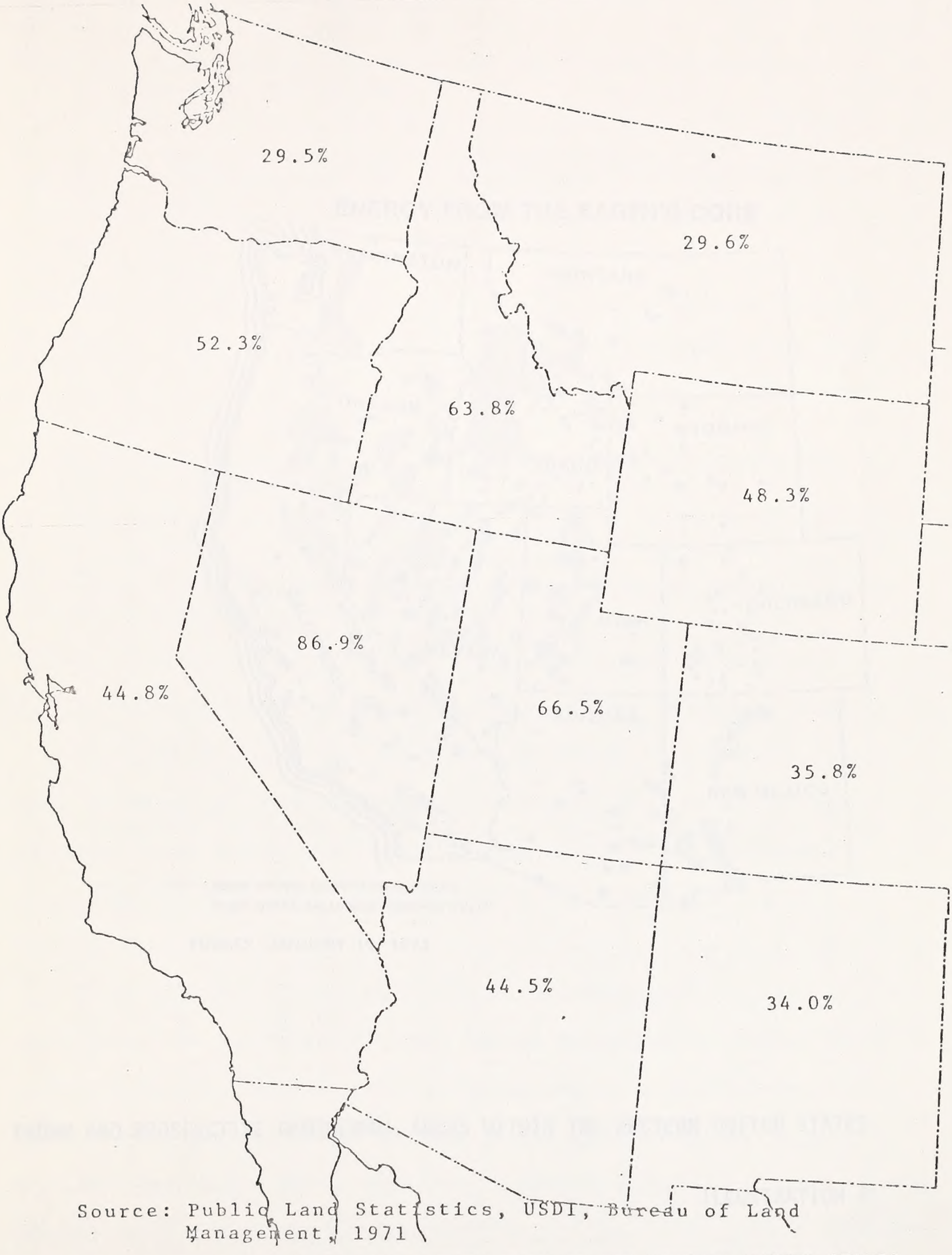
The U. S. Geological Survey has classified approximately 1.8 million acres in the western United States as being within a "Known Geothermal Resource Area" (KGRA) of which one million acres are located on Federal lands (Illustration 4). Another 96 million acres have been classified as prospectively valuable for geothermal resource with Federal ownership being about 58 million acres. During 1974, Federal competitive geothermal lease sales were held in Oregon, Utah, California and Nevada.

Capacities and requirements of electric energy in megawatts for the western states are shown in Table 1.

Geothermal Lease Status in New Mexico

Leases for geothermal development are currently being granted on both state and private lands, but no leases have yet been made on Federal lands to this date.

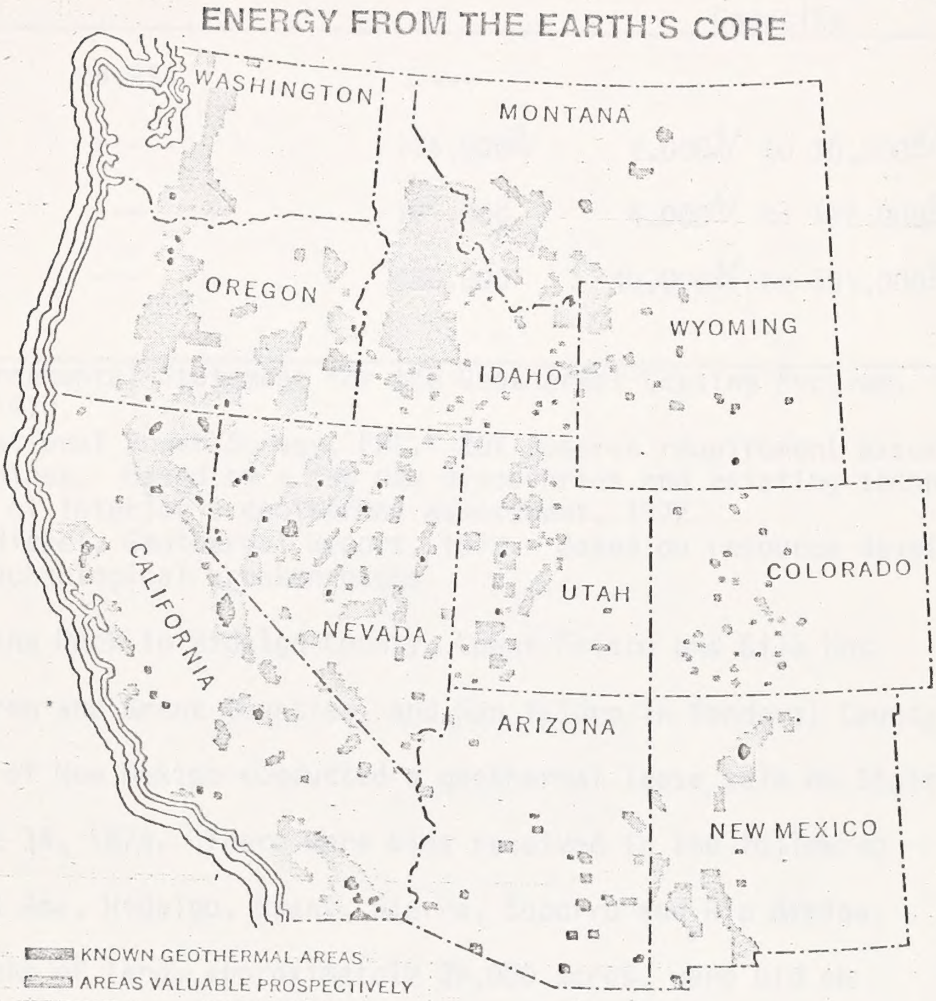
The most active area in New Mexico is the Baca Location No. 1, which is presently under private lease and undergoing development. The Baca Area is the only KGRA officially declared by the U.S. Geological Survey for the State of New Mexico at this time. Other areas being consiered for KGRA designation in New Mexico are Kilbourne Hole and Radium Springs in Dona Ana



Source: Public Land Statistics, USDI, Bureau of Land
Management, 1971

PERCENTAGE OF FEDERALLY OWNED LAND WITHIN EACH OF THE WESTERN UNITED STATES

ILLUSTRATION 3



FORBES, JANUARY 15, 1973

KNOWN AND PROSPECTIVE GEOTHERMAL AREAS WITHIN THE WESTERN UNITED STATES

ILLUSTRATION 4

Table 1. Capacities and requirements of electric energy in megawats for the western states. 1/

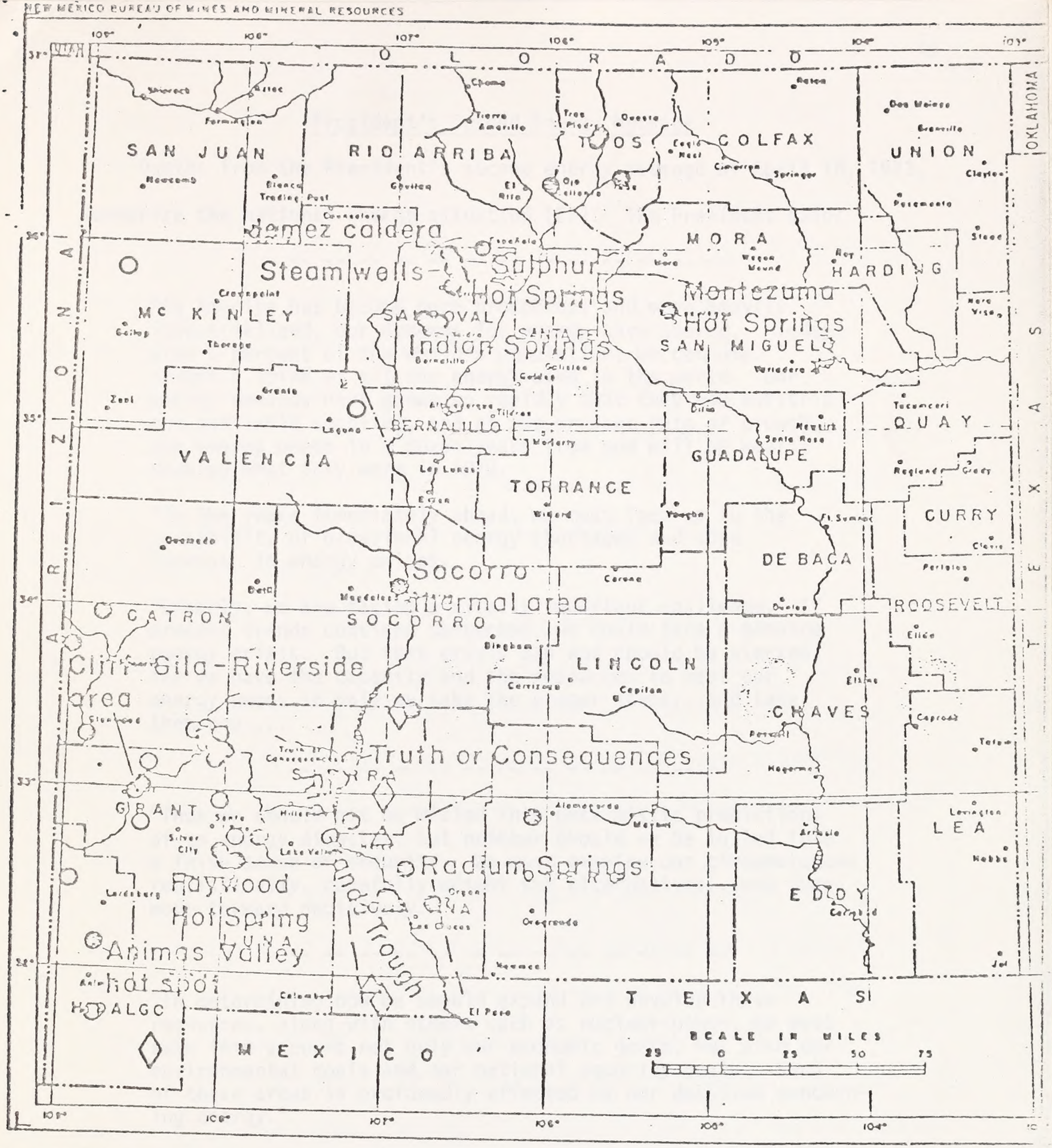
Year	Installed Generating Capacity	Future Requirements	Estimated Geothermal Capacity
1971	66,984	---	
1980	---	136,000 2/	2,000 3/ to 10,500 4/
1985	---	191,000	4,000 4/ to 132,000 5/
2000	---	480,000	40,000 3/ to 395,000 5/

1/ Final Environmental Statement for the Geothermal Leasing Program, U.S.D.I., 1973.
2/ Based on National Power Survey, FPC. 20% reserve requirement assumed.
3/ Bureau of Mines. Based on a few new discoveries and existing technology.
4/ Department of Interior's geothermal assessment, 1972.
5/ Walter J. Hickel, Geothermal Report, 1972. Based on resource development and technological breakthroughs.

County, Lightning Dock in Hidalgo County, Lower Frisco and Gila Hot Springs in Catron and Grant Counties, and San Ysidro in Sandoval County.

The State of New Mexico conducted a geothermal lease sale on State lands on August 14, 1974. There were bids received in the following counties: Dona Ana, Hidalgo, Grant, Sierra, Socorro and Rio Arriba. Ninety-two tracts of land, approximately 39,000 acres, were bid on (Illustration 5).

Since January 1, 1974, the Bureau of Land Management has accepted applications for geothermal leases. Through October 1974, a total of 382 applications were submitted by 48 different companies and individuals for approximately 900,000 acres. Counties which have applications pending for geothermal leases are: Rio Arriba, Sandoval, Bernalillo, Catron, Grant, Socorro, Sierra, Dona Ana and Luna.



⊙ Thermal area, field checked and sampled

△ Thermal area, field checked not sampled

◇ Oil test reporting thermal anomaly, plugged and abandonded

○ Thermal area not field checked, but reports believed reliable

GEOTHERMAL ANOMALIES WITHIN NEW MEXICO ILLUSTRATION 5

President's Second Energy Message

Quotes from the President's second energy message of April 18, 1973, summarize the national energy situation (27). The President said:

-- -- -- -- -- -- -- -- -- -- -- -- --

> "As America has become more prosperous and more heavily industrialized, our demands for energy have soared. Today, with 6 percent of the world's population; we consume almost a third of all the energy used in the world. Our energy demands have grown so rapidly that they now outstrip our available supplies, and at our present rate of growth. our energy needs in a dozen years from now will be nearly doubled what they were in 1970.
>
> "In the years immediately ahead, we must face up to the possibility of occasional energy shortages and some increase in energy prices.
>
> "Clearly, we are facing a vitally important challenge. If present trends continue unchecked, we could face a genuine energy crisis. But that crisis can and should be averted, for we have the capacity and the resources to meet our energy needs if only we take the proper steps...and take them now....

-- -- -- -- -- -- -- -- -- -- -- -- --

> "Thus we should not be misled into pessimistic predictions of an energy disaster, but neither should we be lulled into a false sense of security. We must examine our circumstances realistically, carefully weight the alternatives...and then move forward decisively.

-- -- -- -- -- -- -- -- -- -- -- -- --

> "In determining how we should expand and develop these resources, along with others such as nuclear power, we must take into account not only our economic goals, but also our environmental goals and our national security goals. Each of these areas is profoundly affected by our decision concerning energy."

-- -- -- -- -- -- -- -- -- -- -- -- --

The Geothermal Steam Act of 1970

The Act was passed by the United States Congress and provides for the development of the federally owned geothermal resource. The

Secretary of the Interior is authorized to make disposition of geothermal steam and the associated geothermal resource.

Federal lands that can be leased for geothermal development are specified in the Act and include those administered by the Secretary of Interior (public, withdrawn, and acquired), those administered by the Forest Service, Department of Agriculture; and lands which contain a reservation to the United States. Also, the various aspects of leasing are defined, including the method of leasing, requirements of a lessee, terms for the contracts, mineral reservations, royalties, acreage limitations, relinquishments, suspensions, terminations, surface use, waste prevention and unit plans.

On January 1, 1974, Title 43 of the Code of Federal Regulations, Group 3200, and Title 30 Part 270 became effective (Appendix A and B). The purpose of these regulations is to implement the Geothermal Steam Act of 1970. Prior to the passage of these regulations, public hearings were held and comments were solicited. Later this information was incorporated into the regulations.

On October 6, 1971, a draft programmatic environmental statement was released for public review and the final environmental statement for the geothermal leasing program was issued on October 23, 1973. The statement discusses the environmental impact of leasing the geothermal resource on Federal lands and also makes recommendations for inclusion in leases and regulations for the mitigation of impacts on the environment.

BLM field offices have been instructed to conduct 15 competive geothermal lease sales of approximatley 200,000 to 300,000 acres, and issue approximately 1,000 noncompetitive leases in fiscal year (FY) 1975.

Twenty competitive lease sales are proposed for FY 1976 (30).

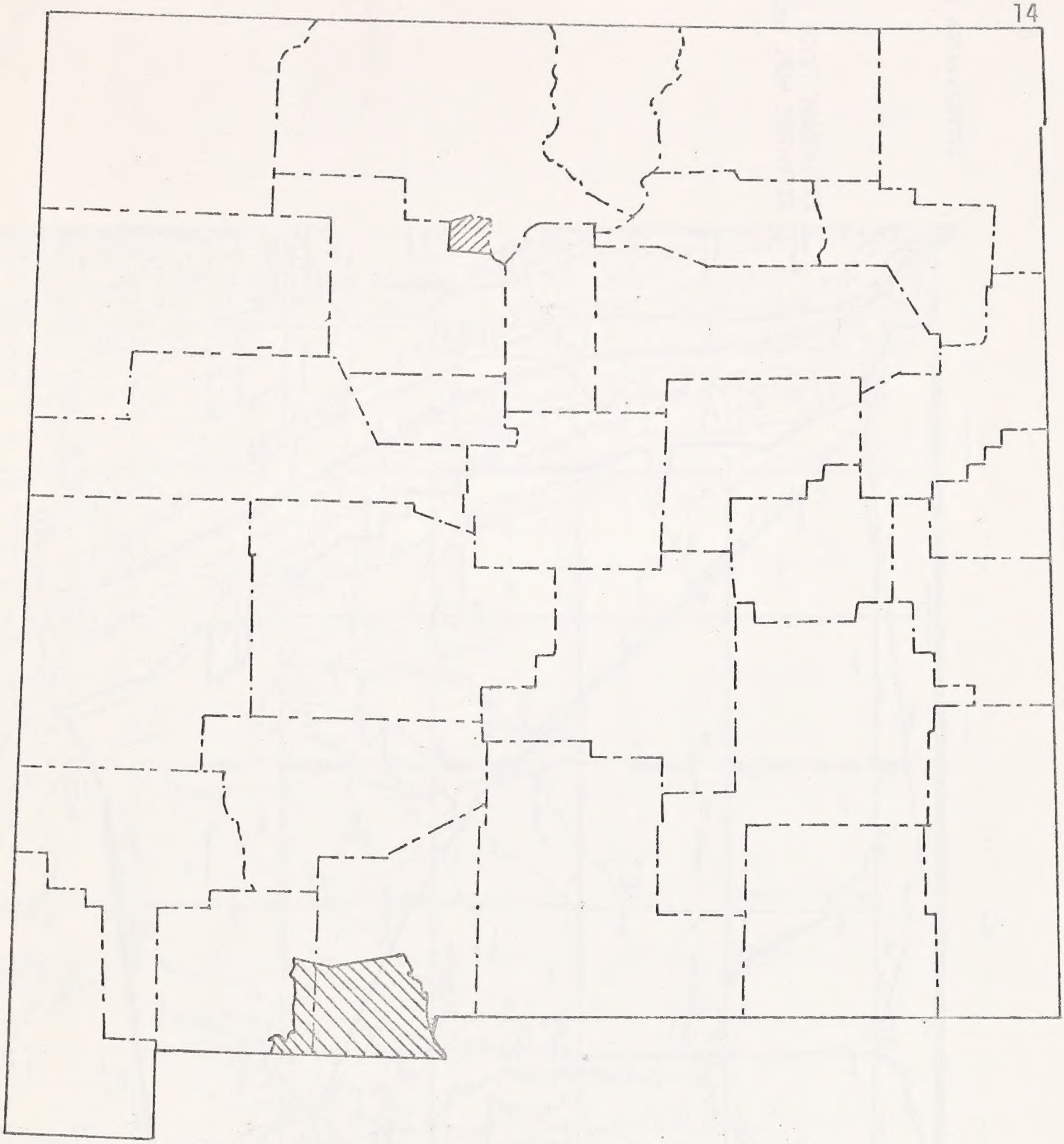
Lands for lease are classified as competitive or noncompetitive tracts. Competitive tracts, offered by sealed bids only, are those located on a KGRA or where lease applications overlap by 50 percent or more. Noncompetitive tracts, offered by simultaneous filing, are those not located on a KGRA and usually have only one applicant.

DESCRIPTION OF THE PROPOSED ACTION

The Proposal

The proposed action is to make available for geothermal leases approximately 400,000 acres of national resource lands located in Dona Ana and Luna Counties, New Mexico, by May 15, 1975. These lands, known as Kilbourne Hole Area, were selected for several reasons: the geology of the area suggests there is good geothermal potential; most of the area is in Federal ownership (both the surface and mineral estate); the lands are contigious and remote with a very sparse population; and the area is presently going through the BLM land use planning system which considers multiple use management. Decisions concerning the proposed lease area will be made before leases are issued (Illustration 6). Lease applications have been received for 278,000 acres of the area considered in this document; however, the study area has been expanded to cover adjoining lands not as yet applied for to insure that all resource environmental values are given fair consideration (Illustration 7).

Tract size would be limited by regulations to a maximum of 2,560 acres per lease (29). The primary term for each lease would be for 10 years and could be extended as long as the geothermal resource is produced in commercial quantities, but in no event for more than 40 years beyond the primary term. The lessee would have a preferential right to renew the lease for an additional 40 year term upon such terms and conditions as the authorized officer deems appropriate. Each company, governmental unit, or individual is allowed to have up to 20,480 acres of federal geothermal leases in any one state (29).



▨ BACA 1 LOCATION

▨ PROPOSED GEOTHERMAL LEASE AREA--(KILBOURNE HOLE -- POTRILLO MOUNTAINS)

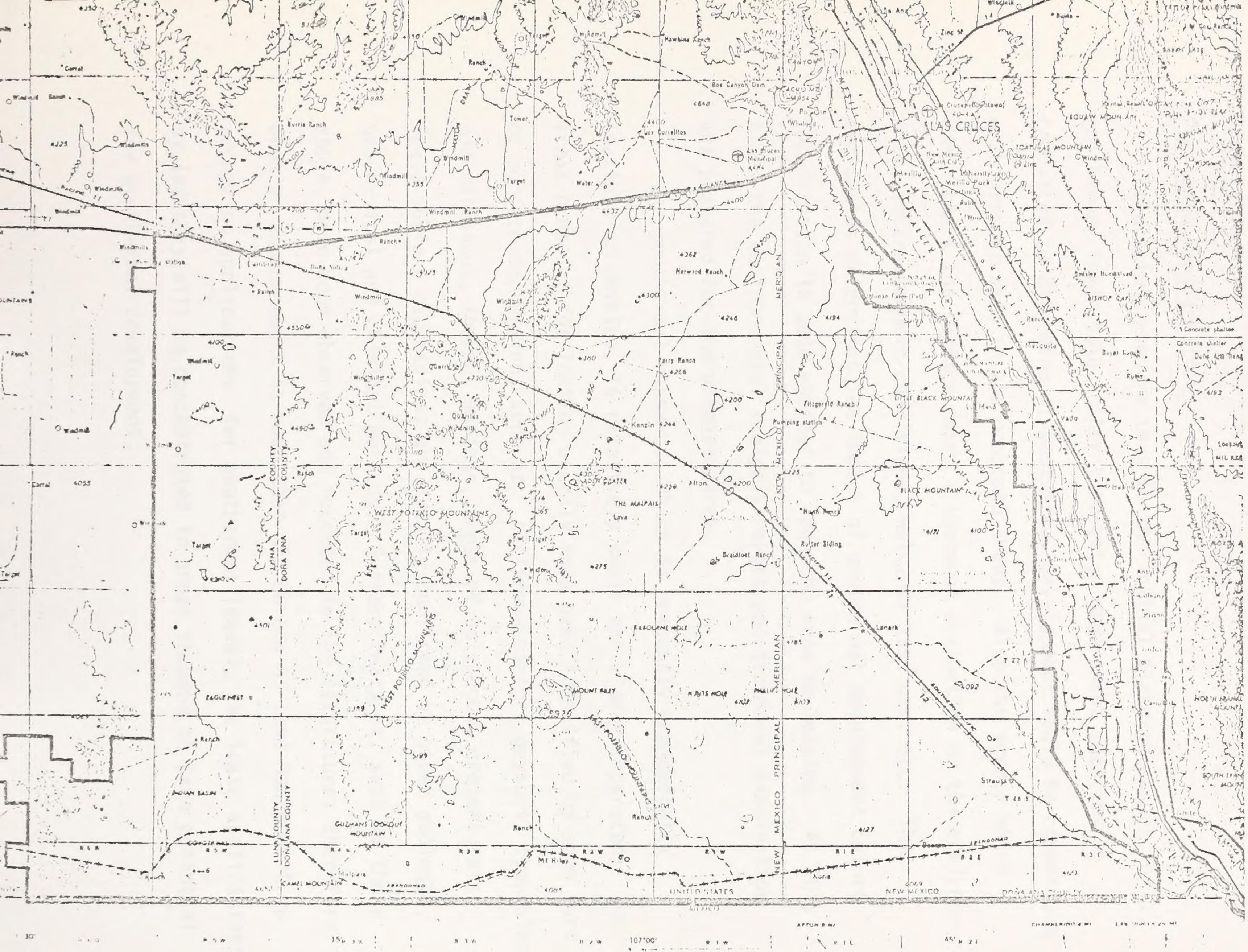
PROPOSED GEOTHERMAL LEASE AREA IN RELATION TO NEW MEXICO

ILLUSTRATION 6

U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

NEW MEXICO

DESIGNED____ RECOMM.____
DRAWN DIAZ RECOMM.____ CHIEF, DIV. OF ENG.
CHECKED____ APPROVED____
[redacted] Feb. 10 1975
DATE | SHEET____ OF____
DRAWING NO.



KILBOURNE HOLE PROPOSED
GEOTHERMAL LEASE AREA

ILLUSTRATION 7

Geothermal activites are divided basically into the following phases: exploration, development, production and close out.

Exploration

Pre-lease Considerations

Regulations require that in the initial planning stages for a geothermal lease sale, other interested government agencies be contacted to determine if geothermal development would be compatible with present uses in the proposed areas. Also the agency which administers the surface makes a thorough evaluation of the environment, socio-economic conditions, multiple land use, etc. This evaluation determines the impact of geothermal development before the decision is made whether to open the area to leasing. At this time, the environmental analysis report and technical examination are prepared for the proposed area.

The geothermal resource, which is presently economically feasible to develop, is relatively small and widely separated. The areas proposed for leasing usually have been identified by some form of surface expression, such as: siliceous sinter, geysers, fumaroles mud volcanoes, thermal springs, areas of volcanoes, craters, etc. These surface expressions are usually confirmed by other geologic, geophysical and chemical methods. Surface features, such as those above, have been observed and recorded in the literature; therefore, when an announcement is made that the Bureau of Land Management is accepting applications for geothermal leases, the lease applications by industry will be concentrated in areas thought to have potential for geothermal development.

After the decision has been made to open an area to leasing and a list of available tracts has been published, the on-the-ground exploration activities would be expected to commence, particularly in a KGRA, where tracts are leased to the highest bidder. The intensity of this phase depends on the number of companies that are interested in a certain area and how high industry regards the geothermal potential.

The pre-lease on-the-ground exploration is divided by regulation into two categories: casual use and exploration operations.

Casual Use

Casual use is the type of activity which has little or no surface disturbance or impact on the environment and does not require a permit, environmental analysis report or a surface protection technical examination. Existing roads and trails are usually used in this type of activities. Examples are:

Geological studies

This is usually accompanied by one or more men on foot, using surveying instruments and maps to obtain and record data. The studies consist mainly of obtaining data on tectonics, stratigraphy, faulting and distribution of volcanic and hydrothermally altered rock.

Hydrologic and geochemical surveys

These are made by sampling springs and water which are present on the lands. Temperature, rate of flow, water migration and chemical analysis of water and gases provide an insight into the geothermal potential.

Airborne or aerial surveys

This includes primarily aerial photography (color, black and white), thermal infrared, radar imagery, gravity and magnetic surveys. These methods are used to determine geologic structures, stratigraphy, and thermal potential of the area.

Radiometric

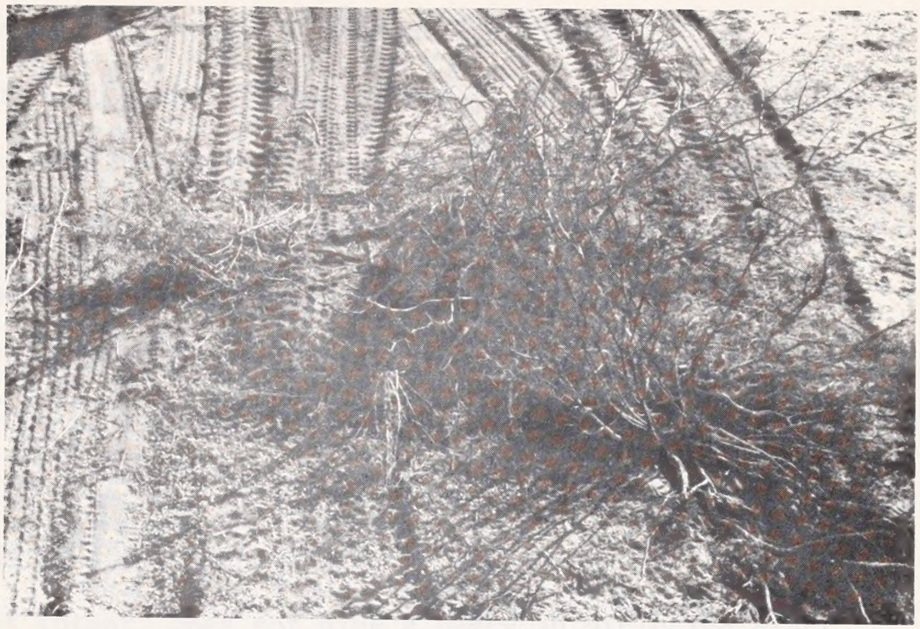
Radiometric determinations are usually made by using a scentillometer (man carried) in a very localized area.

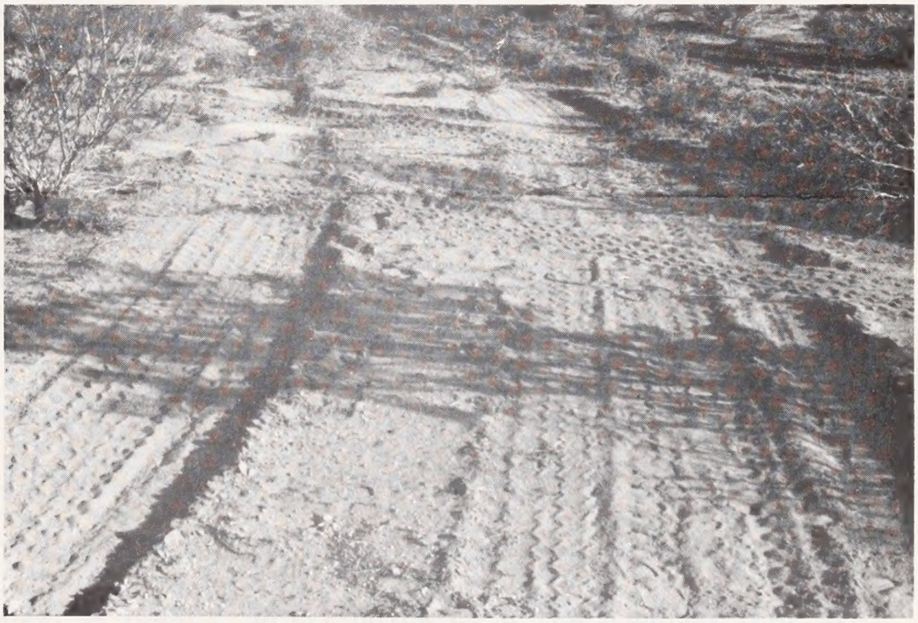
Other

There are other exploration methods which could fall into the "casual use" category, but these can involve intensive use of large areas and usually require travel by vehicles across the land. The methods used in these operations, such as ground gravity, magnetic, resistivity, microseismic and telluric surveys can be conducted so there is only minor impact and little or no surface disturbance. However, a careless operator could have a significant environmental impact and cause substantial surface disturbance; therfore, these exploratory methods would be controlled under a "Notice of Intent" (discussed below).

Exploration operations

Exploration operations consist of activities which could have significant surface disturbance and impact on the environment. For instance, positioning the exploration equipment usually necessitates movement of vehicles across open terrain or some kind of trail or road and construction of the drilling site (Illustration 8).





SURFACE DISTURBANCE FROM SEISMIC EXPLORATION

ILLUSTRATION 8

These operations require an environmental analysis before a "Notice of Intent to Conduct Exploration Operations" can be approved by the authorized officer. Permits of this kind usually require mitigating stipulations and a surety bond of not less than $5,000 for each exploration operation. The bond ensures compliance with regulations and stipulations. After the exploration has been conducted, a "Notice of Completion of Exploration Operations" must be filed. Within 90 days after the "Notice of Completion" is filed, the area of exploration is inspected and, if there has been compliance, the party is so notified.

"Notice of Intent" does not give a party an exclusive right for exploration or obligate the Government to issue a preference right to lease. Examples of exploration methods conducted under a "Notice of Intent" include:

Drill holes

Drill holes involved in exploration to determine geothermal potential of an area can be used to obtain a variety of information. These shallow exploration holes are used mainly for determining temperature gradients, heat flows, lithology, and shallow and deep geologic structures. On the other hand, geothermal and geologic test holes to determine the presence of geothermal resources would be allowed only under a lease. Drill holes of a few hundred feet are usually drilled by portable truck mounted drills and usually require only a short period of time to complete. Therefore, the surface disturbance is reduced significantly.

The drill sites on level terrain require little surface

disturbance; but on steep areas may involve road construction leveling to allow the drilling equipment to function properly. The hole is drilled by rotating a vertical steel pipe on which is mounted a bit that cuts into the earth. The cuttings are removed by forcing high pressure air down through the center of the drill pipe and back out to the surface via the side of the hole. Cuttings are also removed by pumping water or mud down through the center of the drill pipe and back up between the drill pipe and the side of the hole.

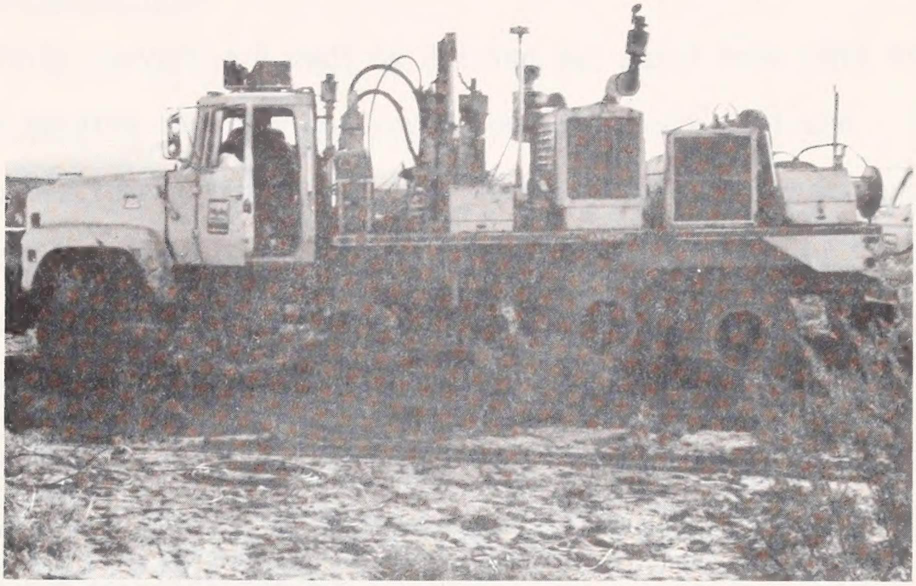
The water used in this method of drilling is usually hauled by truck and stored in a steel tank (pit) or earth pit during the drilling operation. The steel pit causes minimal surface distrubance, but the earth pit requires considerable reclamation. When necessary, excess drilling fluid can be hauled off and disposed of in an acceptable place.

Seismic methods

Deep geologic structures can be determined by seismic methods which can require the detonation of explosives in drill holes to generate sound waves that are recorded at various points. However, this method is being replaced by vibration and thumping methods. These methods require truck mounted equipment to move about the terrain. Vibrations are produced from the truck's vibrator, whereas, the thumping method requires the dropping of a heavy weight on the land's surface which produces shock waves (Illustration 9).

Microseismic survey

Microseismic is a method of detecting micro earthquakes by burying small seismometers at a shallow depth and recording the



SEISMIC TRUCK VIBRATION EQUIPMENT

VIBRATOR ATTACHMENT ON GROUND SURFACE

VIBRATION EQUIPMENT USED IN SEISMIC WORK

ILLUSTRATION 9

Seismic activity. Surface disturbance should be minimal, depending on how the operation is conducted.

Resistivity surveys

Resistivity surveys are made by driving two metal rods into the ground or by burying aluminum foil over several square feet and transmitting electrical current through the electrodes to receivers at a distance where resistance of the subsurface strata to the electrical current can be determined. This survey can be conducted on wide spacing, necessitating the movement of vehicles over the terrain. In some areas, existing road and trail development may be sufficient so there is little surface disturbance.

Gravity and magnetic surveys

Gravity and magnetic surveys can also be made on-the-ground. Portable instruments are transported by vehicles across the terrain and readings are usually taken on a grid.

Telluric surveys

Telluric surveys involve recording variations in natural electrical currents in the earth by using portable equipment. Surface disturbance should be minimal, depending on the method of transporting the instruments.

Exploration plan

Regulations require a proposed "Exploration Plan" be submitted by applicants to the Bureau of Land Management before the issuance of geothermal leases (29). The primary purpose of the plan is to ensure diligent exploration and give an insight into the on-the-ground operations which are planned for the specified area before the lease

is issued. Lease terms in the contract are also designed to encourage diligent exploration and development of the geothermal resource.

Geothermal lease contract

Among the provisions of the lease contract, there are specific sections which require protection of the environment, antiquities, historic values, etc. In addition, special stipulations needed to protect unique values of a particular area may be incorporated into the lease contract and compliance becomes mandatory. Prior to the issuance of a lease, an applicant must furnish a lease compliance bond for not less than $10,000 and a protection bond of not less than $5,000.

Post-lease considerations

After a lease has been issued, not only would the lessee be under the surveillance of the surface managing agency, but he would also be responsible to the U. S. Geological Survey for all operations conducted on the leased lands. Federal regulations require that before operation activities commence on the leased lands, a detailed "Plan of Operation" (with maps and narrative statement) must be submitted to the Geological Survey. A "Plan of Operation" will be approved by the Geological Survey only after consulting with other Federal and State agencies involved and other interested parties.

In addition to the precautions taken to protect the environment, the regulations give the U. S. Geological Survey jurisdiction over all activites within the area of operation and require that these activities conform to the best practice and be conducted to protect

the mineral deposits so that there is maximum recovery and minimum waste. These operations are further required to be compatible and conducted in such a manner that other land uses and the environment are fully protected. Failure to comply with the lease contract rules and regulations can result in cancellation of the lease.

The U. S. Geological Survey also issues Geothermal Resource Operational Orders (GRO Orders) which implement the regulations (30 CFR 270) and sets forth the procedures and regulations relating to the operations in an area or region (28 and 29).

After a competitive lease has been granted, in most cases the lessee can be expected to do additional exploration which would eventually result in the drilling of an exploratory well, cancelling of the lease, or stalling for time to see what the results are of other similar operations in the area.

When a non-competitive lease is issued, it often results in exploration unless the lessee can entice another individual or company with substantial financing to join in the venture. Leases which fall into this category usually would be applied for on the basis of limited geologic information, but enough geologic evidence to interest another party in the geothermal potential of the lease so that further geologic and geophysical studies would be warranted. Also, leases of this type could be expected to be held indefinitely with no on-the-ground operations while waiting to see what developed in other nearby areas. In some cases, blocks of non-competitive acreage would be leased and exploration would proceed as though the acreage was located on a KGRA.

Pre-lease exploration methods have been defined previously. However, exploration after issuance of a lease can and usually does include those methods on a more intensive basis.

Geologic information holes

Deep exploratory holes (1,000 feet or more) drilled for geologic information require large rigs and, because of this can cause more surface distrubance than portable truck mounted drills. Deep holes require large volumes of drilling fluid or bigger air compressors to remove drill cuttings from the bottom of the hole. The drill pad would also be larger and probably require more leveling. The time required to drill the hole takes several days or weeks and the road into the location would receive intensive use, necessitating blading. A drill hole such as this can provide tangible data to determine the subsurface geologic conditions. The drill cuttings and cores would indicate geologic and reservoir conditions. Geophysical logging of drill holes are also very helpful in evaluating the geothermal potential of an area. If fluids are encountered, chemical analysis may provide valuable information.

Exploration wells

After the exploration work has been completed and the best location to test the area for the geothermal resource has been determined, a drilling site with mud pits is prepared, probably requiring a clearing of 2 to 3 acres. A large drilling rig is then moved onto the site (Illustration 10). If air is used to remove the cuttings from the drill hole, mud pits are not necessary. However, some type of entrapment is necessary to catch the cuttings. If the well is drilled with mud, there must be a good

GEOTHERMAL DRILL RIG.

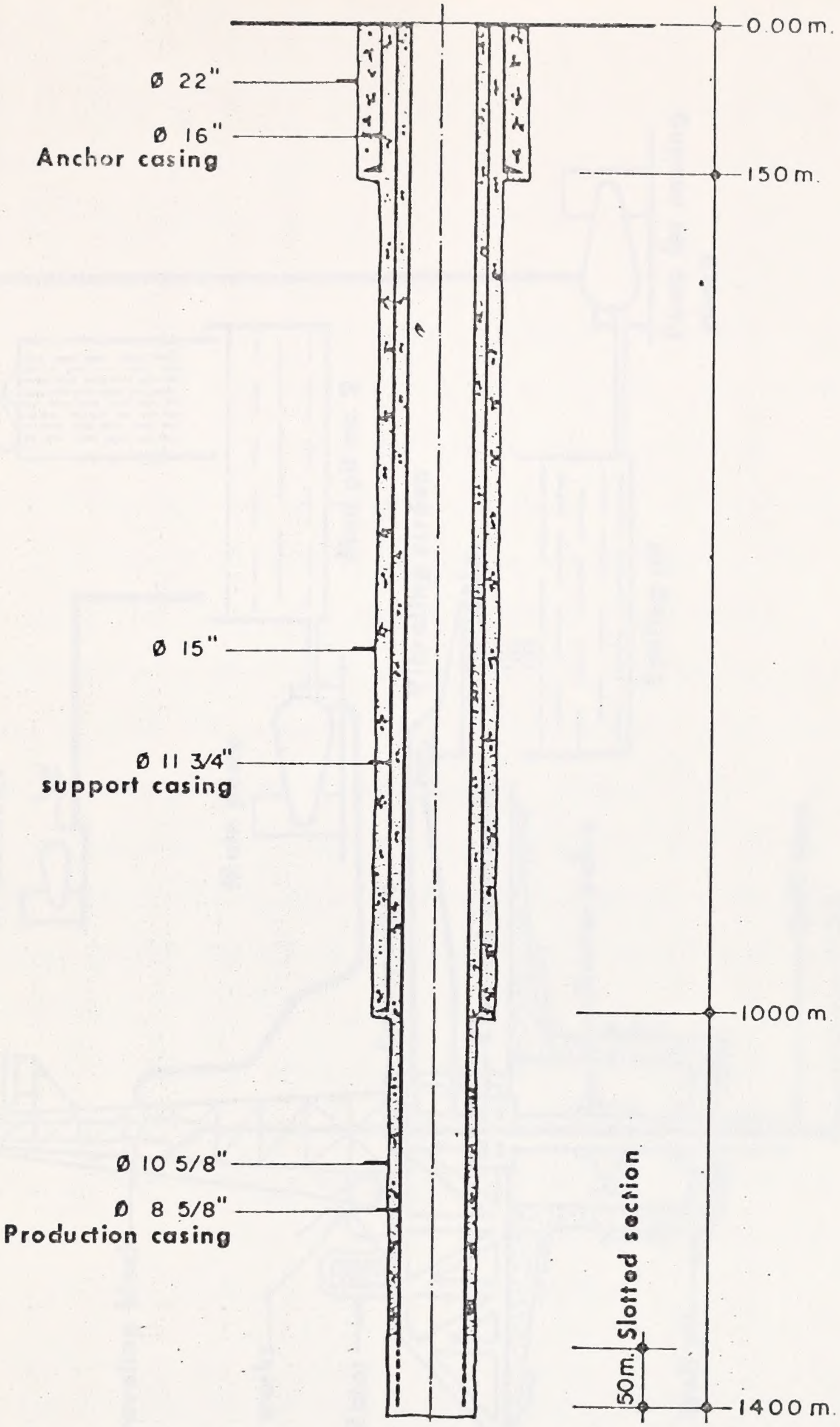
ILLUSTRATION 10

source of water available. Precautions are necessary to prevent loss of drill mud if earth pits are used. Drilling with air causes more noise at a drill site than drilling with mud. Also air drilling is used in areas where little or no water flows are encountered in the subsurface.

An exploration hole is often referred to as a "wildcat," meaning the purpose of the hole is to test the subsurface strata for the geothermal resource in an unexplored area. Due to the depth of these holes (ranging from possibly 1,000 to around 10,000 feet), the hole diameter is larger (up to 24 inches) at the ground surface and, as the hole is drilled, the hole size is reduced as casing is set and cemented at certain depths (Illustration 11).

Occasionally, zones in the subsurface strata have sufficient pressure to blow drilling fluid out of the hole unexpectedly. Also mud temperatures can cause blowouts. In preparing a drill rig, a blowout preventer is installed beneath the rig's floor on the surface casing so that when such a zone is penetrated, the well can be shut in and no fluids or gases are allowed to escape (Illustration 12). If the well is not shut in, fluids, gases and steam could be spread onto the adjacent lands.

In the Geysers area in California, the wells are approximately 7,000 - 8,000 feet deep. The holes are drilled to approximately 4,000 feet with mud, where casing is set and cemented. Drilling below that depth is with air so that the steam reservoir is not damaged or plugged off by the drilling mud. As the bore hole penetrates the strata, fractures or conduits are encountered which direct the steam into the



Profile of typical geothermal well completion at Cerro Prieto, Mexico, showing three casings encased in cement with slotted liner for producing hot water on bottom.

ILLUSTRATION 11

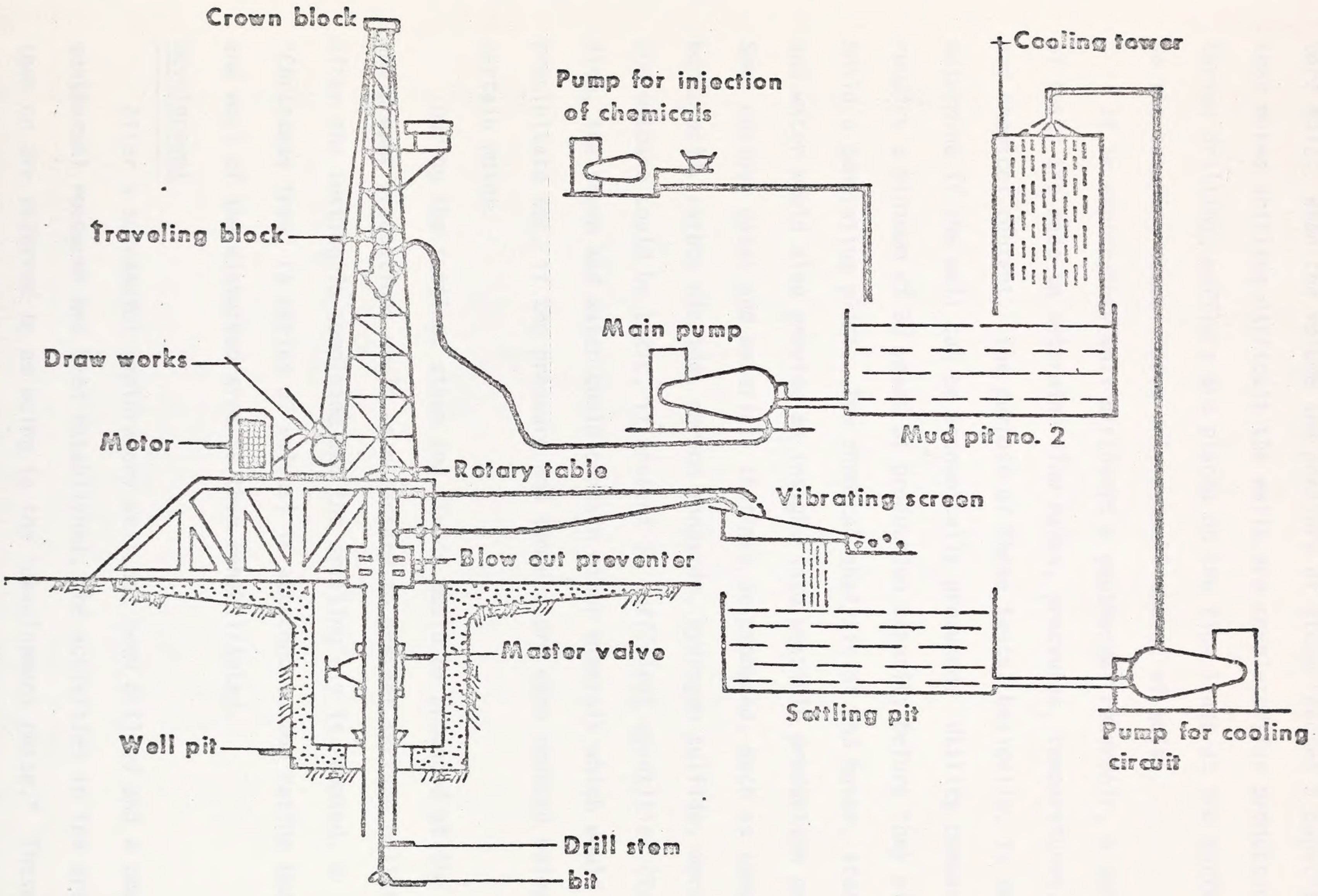


DIAGRAM OF TYPICAL DRILLING ARRANGEMENT IN GEOTHERMAL DEVELOPMENT.

ILLUSTRATION 12

bore hole. When the volume and pressure of steam reaches a capacity that makes drilling difficult the wells are completed for production. During drilling, mufflers are placed on the flow lines at the surface so the escaping steam causes only a small amount of noise.

If an exploratory well discovers a geothermal reservoir, a series of tests are made to determine flow rates, pressures, temperatures, and chemical content. The purpose of these tests, basically, is to determine if the well can be economically produced. Utility companies require a minimum of 30 years of production capacity before they will build a generating plant. The chemical analysis of the bases, steam, and water would also provide an insight into possible production problems. Some noxious gases and materials that may be produced, such as ammonia, boric acid, carbon dioxide, carbon monoxide, hydrogen sulfide, mercury, and methane could be toxic, if present in sufficient quantities (Table 2). Also, the steam and water could contain other minerals which would precipitate out, if the pressure and temperature were reduced below a certain point.

During the testing, steam and fluids would be produced at the surface and proper precautions would be necessary to prevent surface pollution. After the testing is completed and the drilling rig is removed, a "Christmas tree" (a series of valves) is attached to the casing head and most of the disturbed area is then rehabilitated.

Development

After a successful exploratory well has been drilled and a commercial geothermal resource has been established, the activities in the area from then on are referred to as being in the "development phase." These

TABLE 2 CHEMICAL ANALYSIS OF NON-CONDENSIBLE GASES IN GEOTHERMAL STEAM 1/

Site	Maximum source temperature, °F(°K)	Wellhead temperature, °F(°K)	Noncondensable gas content of total discharge (wt %)	Mole percent						
				CO_2	H_2	H_2S	CH_4	NH_3	N_2	Residuals
Hengill, Iceland	446 (503)	~320 (433)	0.3	84.6	2.1	4.9	0.0	—	—	8.4[a]
Hveragerdi, Iceland	446 (503)	~320 (433)	0.1	78.5	1.1	17.2	—	—	—	3.2[a]
Krysuvik, Iceland	446 (503)	~320 (433)	1.3	83.9	5.4	9.6	0.1	—	—	1.0[a]
Wairakei, New Zealand	509 (538)	~383 (468)	0.01–0.5	93.0	0.8	3.8	0.8	~0.2	1.4	—
Waiotapu, New Zealand	563 (568)	—	0.07–0.2	90.0	1.5	7.8	0.3	~0.2	0.2	—
Larderello, Italy (1870)	—	—	—	90.5	2.0	4.2	1.4	—	1.9	—
Larderello, Italy (1960)	473 (518)	~374 (463)	4.5	92.4	1.4	2.5	1.0	1.7	0.6	0.4[b]
The Geysers, California	>401 (478)	347 (448)	0.7	69.3	12.7	3.0	11.8	1.6	1.6	—
Showa-shinzan Volcano, Japan	—	381 (467)	0.6	69.4	12.4	3.9	0.1	0.0	9.1	5.1[c]
Showa-shinzan Volcano, Japan	—	622 (601)	2.2	84.9	6.6	1.0	0.1	0.0	5.2	2.2[c]

[a] Includes N_2.
[b] Primarily H_3BO_3.
[c] Primarily HCl, with lesser amounts of HF and SO_2.

1/ Taken from Kruger, Paul and Carel Otto, Geothermal Energy, 1973., Stanford University Press.

activities are authorized under a "Plan of Operation" and the lands in the development area are subjected to much more intensive use.

When sufficient wells have been drilled to operate a power plant, construction would probably commence, although development drilling would continue until the field was fully explored and developed.

Development wells

The information obtained during the exploratory phase is very helpful in planning field development (well locations). Additional geophysical work may be conducted in order to gain more detailed information. Development wells are drilled and completed basically the same as the exploratory wells and require the same consideration.

After a discovery has been made, a development program is usually formulated. As new data becomes available, the program is modified, but this is a critical time from the standpoint of environmental impact and surface disturbance. For instance, if the development wells are to be drilled on 20-acre spacing rather than 40-acre, the surface disturbance will be greater. There will be more service roads, pipelines, surface equipment, etc. However, if the wells are to be slant drilled on 20- or 40-acre spacing from a central location, the impact would be significantly less. The capability of a company to conduct slant drilling (directional drilling) depends on economic, mechanical, and geologic considerations. The variability of these factors from area to area may make slant drilling impractical.

The number of development wells drilled per section would probably depend on a number of factors, including the type of geothermal resource (steam or hot water), temperature, capacity of the wells, size of the

power plants, and reservoir conditions.

At the Geyers, the development wells were initially drilled on 40-acre spacing and then reduced to 20- to 30-acre spacings with approximately 10 to 20 wells producing into one power plant generating approximately 110 Mw of electricity (latest construction).

The Cerro Prieto, Mexico, geothermal field (hot water) has approximately 15 producing wells drilled on 10-acre spacing that produce into a 75 Mw power plant.

Pipelines and roads

The number of roads and pipelines, as stated previously, would be directly related to the method of field development and the intensity of the development. Usually, frequency of road use and the severity of the weather determines to a large extent, how elaborately the roads are constructed. Roads would be mainly associated with drill sites, pipelines, power plants, and transmission lines. There is some flexibility in the location of pipelines, transmission lines, and roads.

Pipelines connecting wells to the power plants range in size from 10 to 30 inches in diameter, and thus far have been constructed above ground because the extreme temperature changes cause movement by expansion and contraction. While the wells are in production, the pipe temperature is probably 350^{o} F. or above, and when the wells are shut down for repairs, the pipeline temperature drops to the surface temperature. An underground pipeline within another larger pipeline is mechanically possible, but not economically feasible at this time. The geothermal pipelines used at the Geysers Field are approximately one mile in length and contain expansion joints and loops. The drop in pressure and temperature limit the length

of the pipelines. These pipelines are insulated to reduce heat loss. They contain centrifugal scrubbers for removing rock particles and mufflers for reducing the noise. The visual impact of these lines can be reduced by painting them to blend with the landscape (Illustration 13).

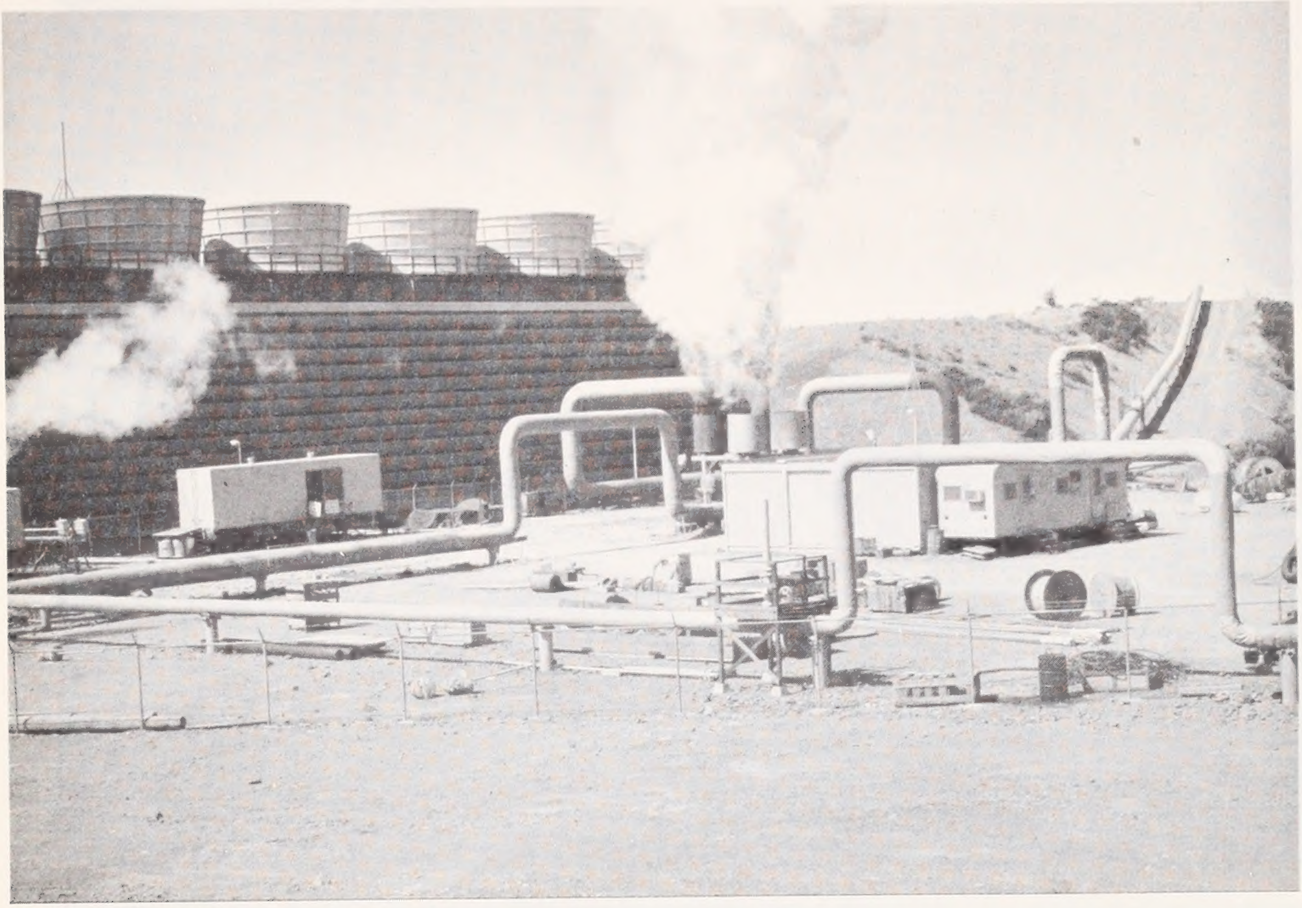
In a geothermal field developed by slant drilling, the whole operation would be very compact and result in less expense for the pipelines; however, the wells would be much more expensive to drill.

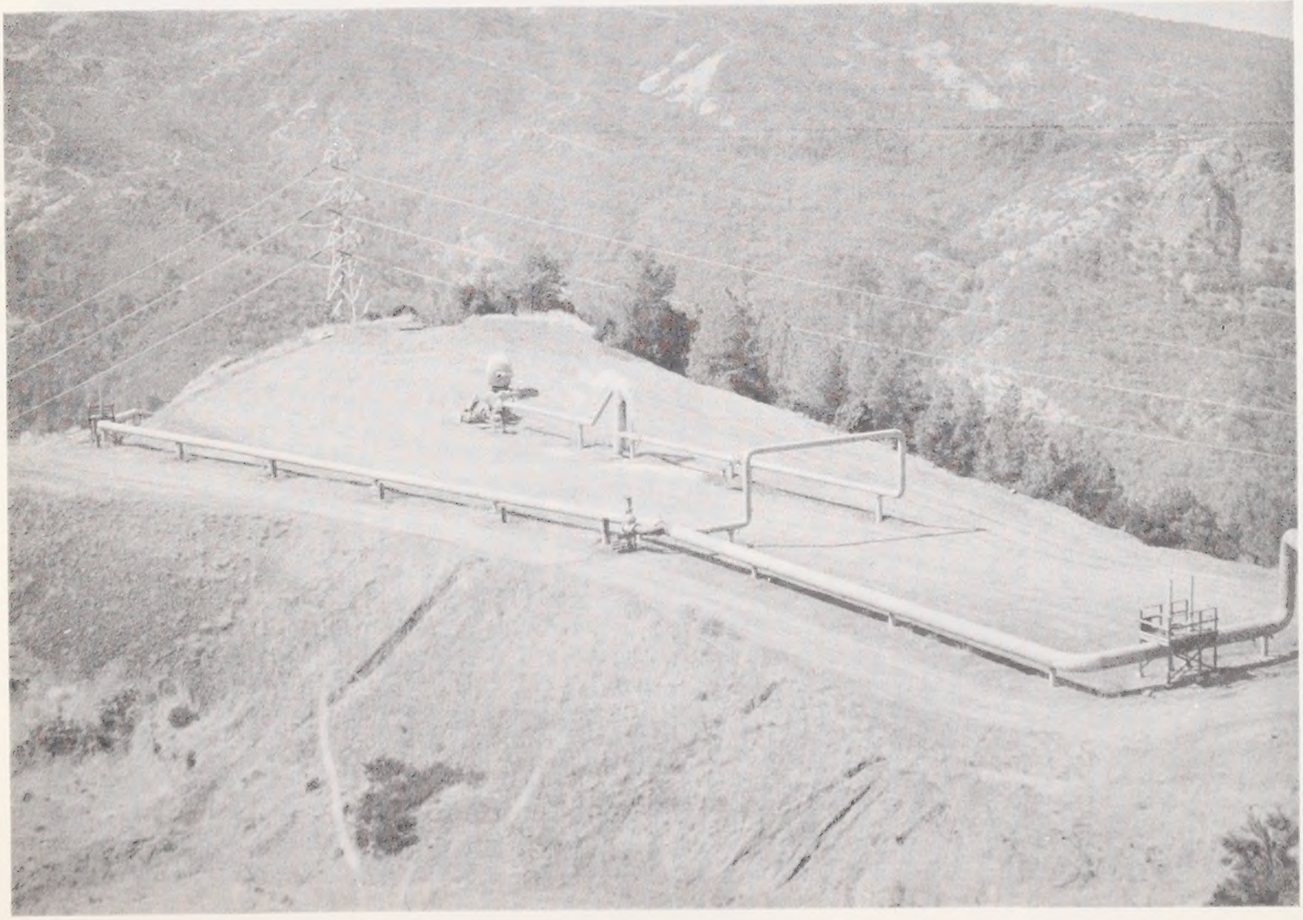
Power plant construction

Geothermal energy use and development is just beginning for all practical purposes, and there appears to be almost unlimited opportunities for technological advancement. Power plant construction is probably one area that will have significant changes in the future.

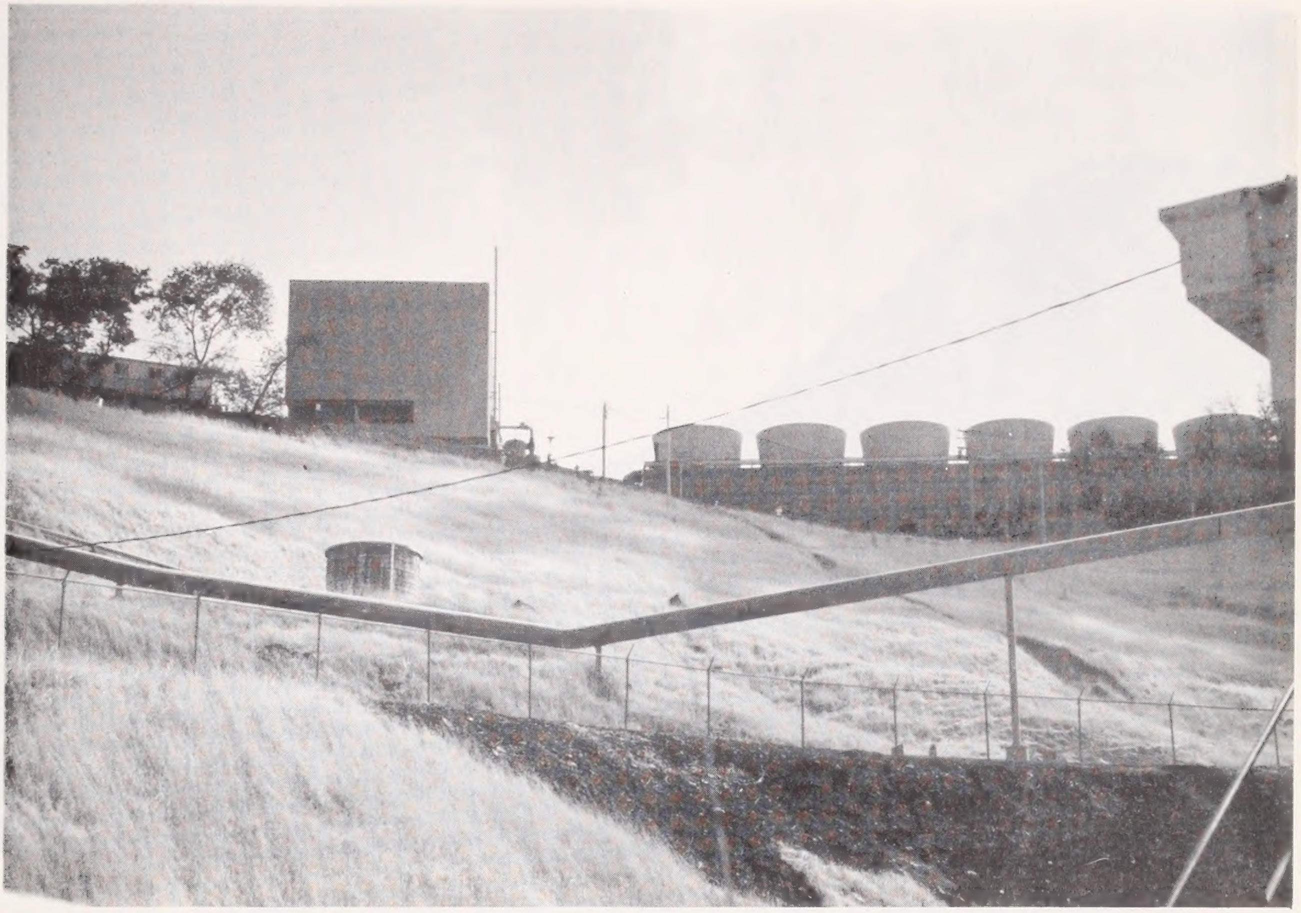
At the Geysers, a power plant, cooling towers and associated structures (parking lots, offices, etc.) occupy an area approximately 3 to 5 acres. The largest power plant generates approximately 110 Mw of electricity or enough electricity to supply a city of 110,000 people. The cooling towers and transmission lines are the tallest structures (Illustration 14 & 15). In geothermal development, a new geothermal field with wells on 40-acre spacing, each well having similar capacity and producing into a power plant of the same size as at the Geysers, there would be about one power plant per section (640 acres).

At the Geysers Field, after the steam has passed through the power plant and the excess water has been cooled in the cooling towers, the remaining water is reinjected into the reservoir via an injection well.

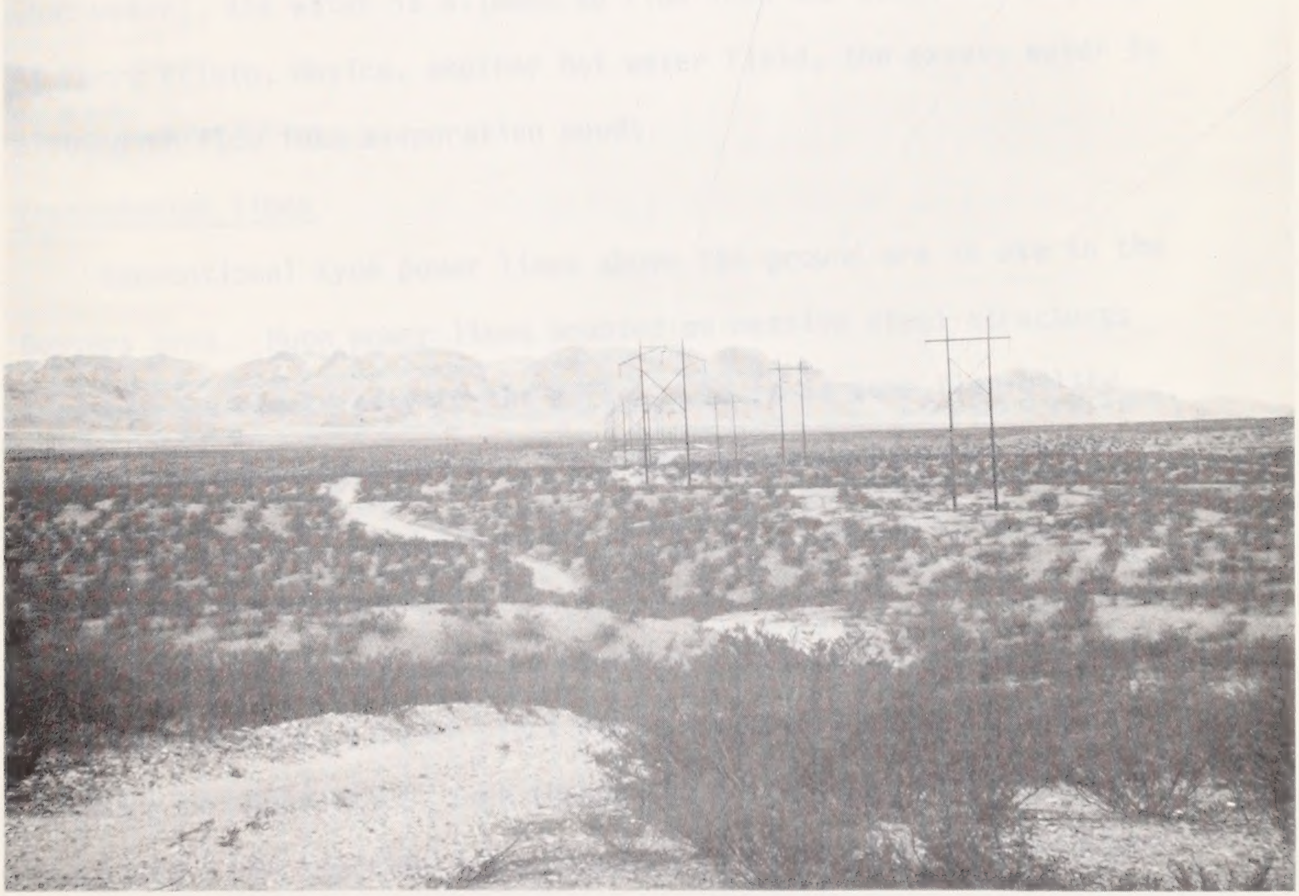




PIPELINES AT THE GEYSERS ILLUSTRATION 13



COOLING TOWERS ILLUSTRATION 14



TRANSMISSION LINES

ILLUSTRATION 15

In the hot water system, there could be problems in utilizing and disposing of large volumes of mineralized water. If hot, mineralized water was used directly in turbines, pipelines, and cooling towers, corrosion and precipitation, associated with pressure and temperature drops, could result in equipment failure.

A "heat exchanger," presently in the experimental stage, is a piece of equipment designed so that the heat in the hot water can be transferred to another media such as freon or iso-butane to drive the turbines. The hot water would then be reinjected into the reservoir. A closed circuit system such as this would eliminate or greatly reduce the problems of scaling, corrosion, disposal of gases, odors, and excess water. In New Zealand, at the Wairakei Geothermal Field (hot water), the water is allowed to flow into the ocean via drainages. At Cerro Prieto, Mexico, another hot water field, the excess water is allowed to flow into evaporation ponds.

Transmission lines

Conventional type power lines above the ground are in use in the Geysers area. Huge power lines mounted on massive steel structures transmit the electricity to the market. There is some flexibility on the routing of transmission lines that can reduce visual impact.

Production

Generating electricity

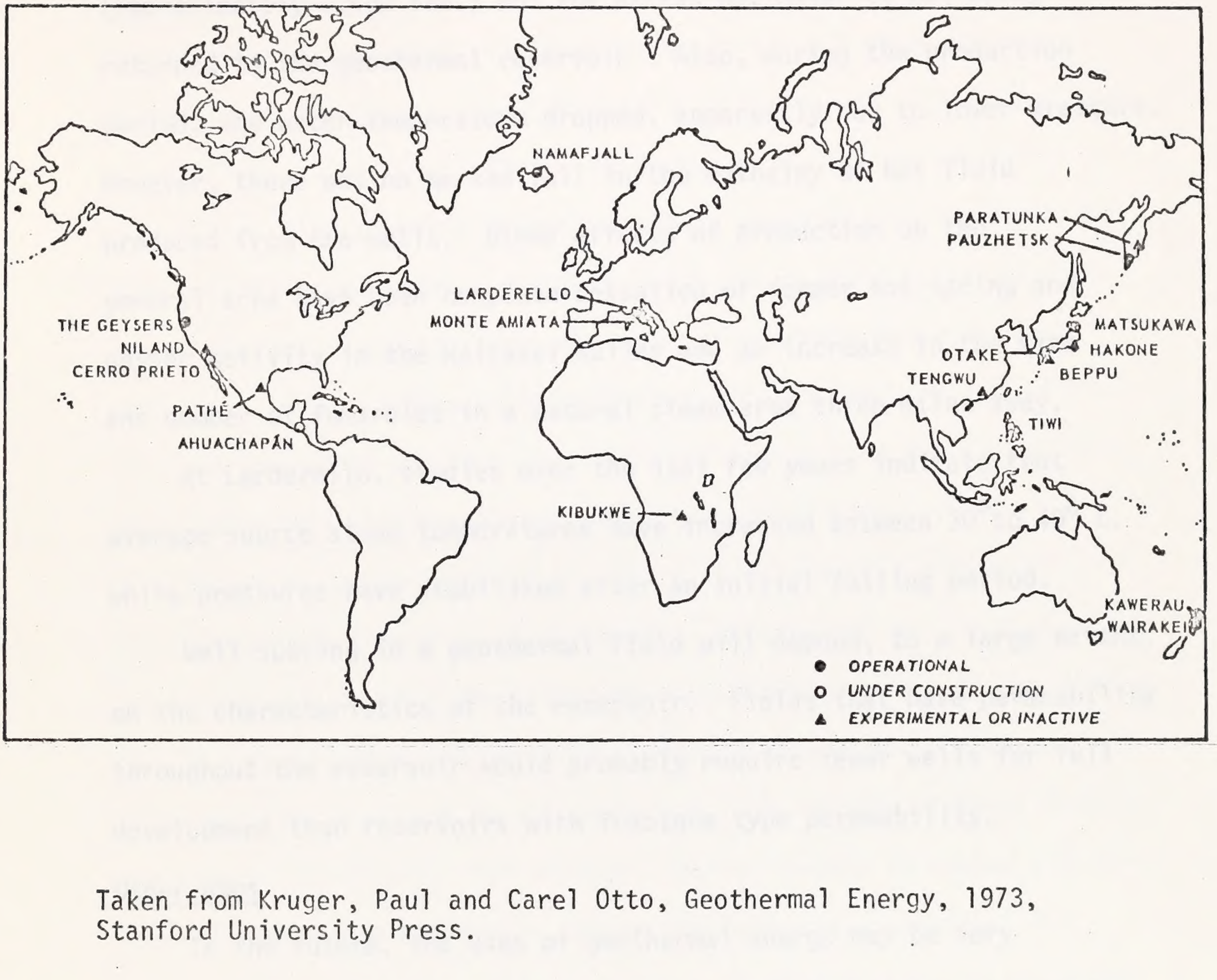
After a discovery has been made and sufficient development wells have been drilled, a power plant and associated equipment would probably be constructed, even though the development drilling is not completed. The lag time from discovery to ultimate field development

in most cases would probably be several years. For example, at the Geysers Field, the first power plant was installed in 1960. Since that time, more wells have been drilled and more power plants constructed. Drilling continues at this time.

Production of the geothermal resource would be expected to commence soon after construction was completed and continue, except for shut downs to repair equipment. Corrosion and scaling could cause equipment fo fail. During production, changes in temperature and pressure have a tendency to precipitate out minerals when present. When repairs are made on wells, a portable workover type rig would probably be used, depending on the type of repairs made. Noise would be reduced by mufflers; however, some gases and fluids may escape while repairs are being made.

Repairs would be necessary from time to time on transmission lines, pipelines, cooling towers, buildings, generators, turbines, etc. However, these repairs should have little impact on the environment after the initial construction.

The life of an average geothermal field is impossible to estimate at this time because production data is very limited. Only two fields have been subjected to high rates of drawoff for periods measurable in decades - the Wairakei Field in New Zealand, and the Larderello Field in Italy (1) (Illustration 16). At the Wairakei Field, acquifer pressures declined during the first few years (1957-1964) of production, and at the same time there was appreciable ground subsidence. By 1970, the ground subsidence and pressure fall had diminished greatly and by 1973 there was no further net loss of mass from the acquifer.



Taken from Kruger, Paul and Carel Otto, Geothermal Energy, 1973, Stanford University Press.

GEOTHERMAL ELECTRIC POWER STATIONS

ILLUSTRATION 16

Apparently, the drawoff is being replaced by natural recharge. The production wells in Wairakei are at relatively shallow depths (approximately 3,400 feet) and the excess hot water is not being returned to the geothermal reservoir. Also, during the production period, the water temperature dropped, apparently due to lower pressure. However, there was no marked fall in the enthalpy of hot fluid produced from the wells. Other effects of production on the general area have been complete cessation of former hot spring and geyser activity in the Wairakei Valley and an increase in the size and number of fumaroles in a natural steam area three miles away.

At Larderello, studies over the last few years indicate that average source steam temperatures have increased between 30° to 40° C. while pressures have stabilized after an initial falling period.

Well spacing in a geothermal field will depend, to a large extent, on the characteristics of the reservoir. Fields that have permeability throughout the reservoir would probably require fewer wells for full development than reservoirs with fracture type permeability.

Other uses

In the future, the uses of geothermal energy may be very diversified. At this time, the generation of electricity appears to be the main use and concern; however, this use requires temperatures of approximately 350° F. or above. No doubt, many reservoirs will be discovered which are considerably lower than 350° F. which can be used in many different ways, such as space heating, product processing, agricultural heating, mineral recovery, air conditioning, desalination, etc.

Technological advancements will determine to a large extent the degree of exploitation and use of geothermal energy.

Close out

A sizable geothermal field in most cases would be abandoned gradually as individual wells were exhausted until the final shutdown of the field. In a small field, an abrupt cessation may be likely.

Before the exhausted production wells are plugged and abandoned, they may have other uses. If these wells are stratigically located, fluids may be reinjected into the reservoir through the exhausted well, that will probably lengthening the life of the remaining field. Also, if the wells are shut in, tests may reveal that the bottom hole temperature and fluids recharge after a lapse of time.

Close out or abandonment of all or a portion of a geothermal field would take place in three phases: abandonment of the subsurface; removal of the surface installations; and rehabilitation of the surface.

The method of abandonment of equipment in the wells would depend on several factors such as the condition, age, method of installation, and type of equipment. For example, casing removal is common practice in wells of nearly all types. After the subsurface equipment has been removed, the hole would be properly plugged to protect the fresh water zones in the subsurface. Cement plugs are usually set at various levels, the casing is cut off below ground surface, and a steel cap is welded over the top of the casing. A marker of the well's location may or may not be installed.

Removal of surface installations such as buildings, roads, foundations and equipment would be accomplished over a period of

time. Many of the installations would be usable at other locations or have salvage value.

Rehabilitation of the field area would probably take considerable time depending on the topography and the size of the developed area. The obliteration of roads would no doubt be difficult to accomplish, particularly where there were cuts and fills in rough terrain. Any usable roads would be retained for future use. Pits and sumps would be filled in, steep areas would be sloped and contoured, and all disturbed areas may be revegetated (Illustration 17).

Alternatives

1. Limit the acreage to those areas which are less environmentally sensitive until further geological information is gained to determine potential of the subject areas.
2. Withhold entire area from leasing until further information is gathered.
3. Do not lease any of the subject area.

NATURAL REVEGETATION OF A ROAD IN THE KILBOURNE HOLE AREA

ILLUSTRATION 17

DESCRIPTION OF THE EXISTING ENVIRONMENT

Non-Living Components

Climate

Precipitation

The climate of the Kilbourne Hole area is arid, with an average annual precipitation of 9.4 inches. Most of the precipitation falls in July, August, and September. Variations in annual precipitation range from less than three inches as a low to a high of 19.6 inches. During years of above average rainfall, rains may begin in June and continue into October (6).

Summer is the wet season of the year. The majority of the precipitation received during this time is by brief high intensity thunderstorms usually accompanied by wind and occasionally by hail. These storms may cause flooding in certain areas. At University Park, Las Cruces, New Mexico, the maximum rainfall recorded in a 24-hour period was 6.5 inches. Precipitation during the summer averages 1.8 inches per month.

Droughts occur about every seven to nine years. Usually the droughts last two to three years but sometimes last as long as five years (19).

The dry season includes the months of October through June. During these months the average monthly precipitation is one-half inch or less. Snow may fall in any one of these months but usually occurs from November to March and averages 2.5 inches per year. December has the heaviest average snowfall of .9 inches.

Snow depth per storm averages two inches but very seldom lasts more than two consecutive days on the ground. One of every three years is without measurable snow (6).

Variation in precipitation may occur due to topographic features. The higher mountains and cinder cones should receive slightly more precipitation than the lower elevations. Surface configuration of a lava flow in the area concentrates water from the precipitation in sink holes. The large subsidence structures (Kilbourne, Hunt's, Phillip's, and others) also concentrate precipitation in low places.

Relative humidity

Average annual relative humidity is 50 percent at University Park, Las Cruces, New Mexico, but varies greatly both diurnally and seasonally. Average annual humidity in the early mornings is about 60 percent and drops to 30 percent in the late afternoons. Spring is usually the driest part of the year with an average relative humidity of 45 percent in the mornings to 20 percent in the evenings. Humidity on December mornings averages near 80 percent and drops to less than 50 percent in the late afternoon (6).

Temperature

The minimum recorded temperature is 8^{O}F while the maximum is 106^{O}F. The average annual temperature is about 65^{O}F.

Spring and summer are the hottest months of the year. Temperatures increase in the spring by about 8^{O}F per month. Summer is the hottest time of year with a mean maximum of 98^{O}F and a mean minimum of 70^{O}F. An average of nine days a year are

recorded at 100^{0}F or higher. Summer nights are generally comfortable because the daily temperature ranges more than 30^0 (6).

Fall and winter are the cool months of the year. In January, the coldest month, daytime temperatures average 70^{0}F for a high and 25^{0}F for a low. The temperature rarely fails to rise above freezing during the day. Temperatures of 10 degrees or lower are recorded an average of two days a year.

Air movement patterns

Air movement is variable in this area. During the winter months winds blow from the north. These winds change their direction and blow from the west in the spring. Moderate strong winds may cause blowing dust and sand during this period, with March having the most frequent strong winds. In the summer and fall the winds change to the southeast. Prevailing winds blow at an average speed of less than six miles per hour. Strong gusty winds causing blowing dust may occur briefly just before summer thunderstorms, but winds are uncommon during clear summer days (6).

Evaporation averages 94 inches a year, about 70 percent of which occurs during the growing season. Average monthly evaporation is shown in Table 3.

Solar radiation

On an annual basis 80 percent of the daylight hours are clear. Average solar radiation is most intense in June and least intense in December (5).

Inversion frequency by seasons, inversion altitudes, and pollutants

Inversion frequency varies highly with both the season and the time of day. Although air inversions are not common in this area, they occasionally occur in the Rio Grande Valley to the east. Inversions develop in the valley in the cool winter months. They normally develop in the early morning and move north up the valley and usually dissipate by midday with increasing morning temperatures. Very few inversions occur in the summer months.

The height of air mixing is at lower elevations in winter and highest in late spring. This mixing height is an indicator of inversion height above the ground. Inversions occur 38 percent of the year in El Paso, Texas area. These inversions occur more frequently during the winter months.

Air pollution is present in the Rio Grande Valley and El Paso, Texas area. The pollutants come from industry and vehicular traffic in the El Paso, Texas area and move northward. The pollution intensity varies with the time of year and the direction and intensity of the winds. Very few vehicles presently use the proposed lease area, thus hydrocarbon emissions are low (5).

Frost-free growing season

The average frost-free period is 200 days from the last spring freeze about April 6 to the first fall freeze around October 15 (Table 3).

The long growing season is typical of this semiarid desert region. Usually the first half of the growing season is dry and

hot while the second half is moist and hot (Table 3). Therefore, plant growth is usually restricted in the first half of the growing season and enhanced in the second half.

Visibility

Average yearly visibility of less than three miles occurs about one percent of the time, usually during January.

Topography

General

The Kilbourne Hole area is an undulating alluvial plain-like surface ranging in elevation from 4150-4360 feet. The West Potrillo Mountains, ranging from 5377-5550 feet, extend north from the Mexican border some 20 miles and varies to 10 miles wide. The East Potrillo Mountains, located southeast of the West Potrillo's, have an elevation of about 5360 feet. These mountains are about 7 miles long and 2 miles wide. The two mountain ranges are north-south uplifts that are in the west portion of the proposed lease area. Mount Riley, a very prominent group of peaks (5915-5957 feet) is situated northwest of the East Potrillo Mountains. Kilbourne, Hunts, and Phillip's Hole are prominent crater-like structures in the central portion of this area, with elevations of 3920, 4017, and 4093 feet, respectively. Other less prominent but similar structures are present. A surface lava flow (Aden Lava Flow) is also present within the northcentral portion of this area. (Illustration 18)

Table 3 Average climatic summary for Las Cruces and vicinity derived from climatic data supplied by New Mexico State University 1/

Month	Prec. in.	Mean Temp.	Evap in.	Snow in.	Avg. Velocity M.P.H.	Prevailing Wind Direction
Jan	0.36	41.4	2.98	0.5	5.3	N
Feb	0.42	45.6	4.39	0.5	6.2	NW
Mar	0.37	51.5	7.60	0.2	7.3	W
Apr	0.20	59.3	10.09	T	7.6	W
May	0.30	67.2	12.28	0.0	6.9	W
June	0.59	76.4	13.27	0.0	6.4	SE
July	1.59	79.4	12.01	0.0	6.0	SE
Aug	1.72	77.5	10.36	0.0	5.1	SE
Sept	1.22	7.14	8.36	0.0	5.1	SE
Oct	0.70	60.6	6.16	0.0	4.7	SE
Nov	0.45	48.7	3.75	0.5	4.7	N
Dec	0.50	41.7	2.67	0.9	4.9	N
Total	8.32		93.92	2.6	5.85	
Avg.		60.0				

Last freezing temperature in Spring 31° Apr. 6
First freezing temperature in Autumn 31° Oct. 15

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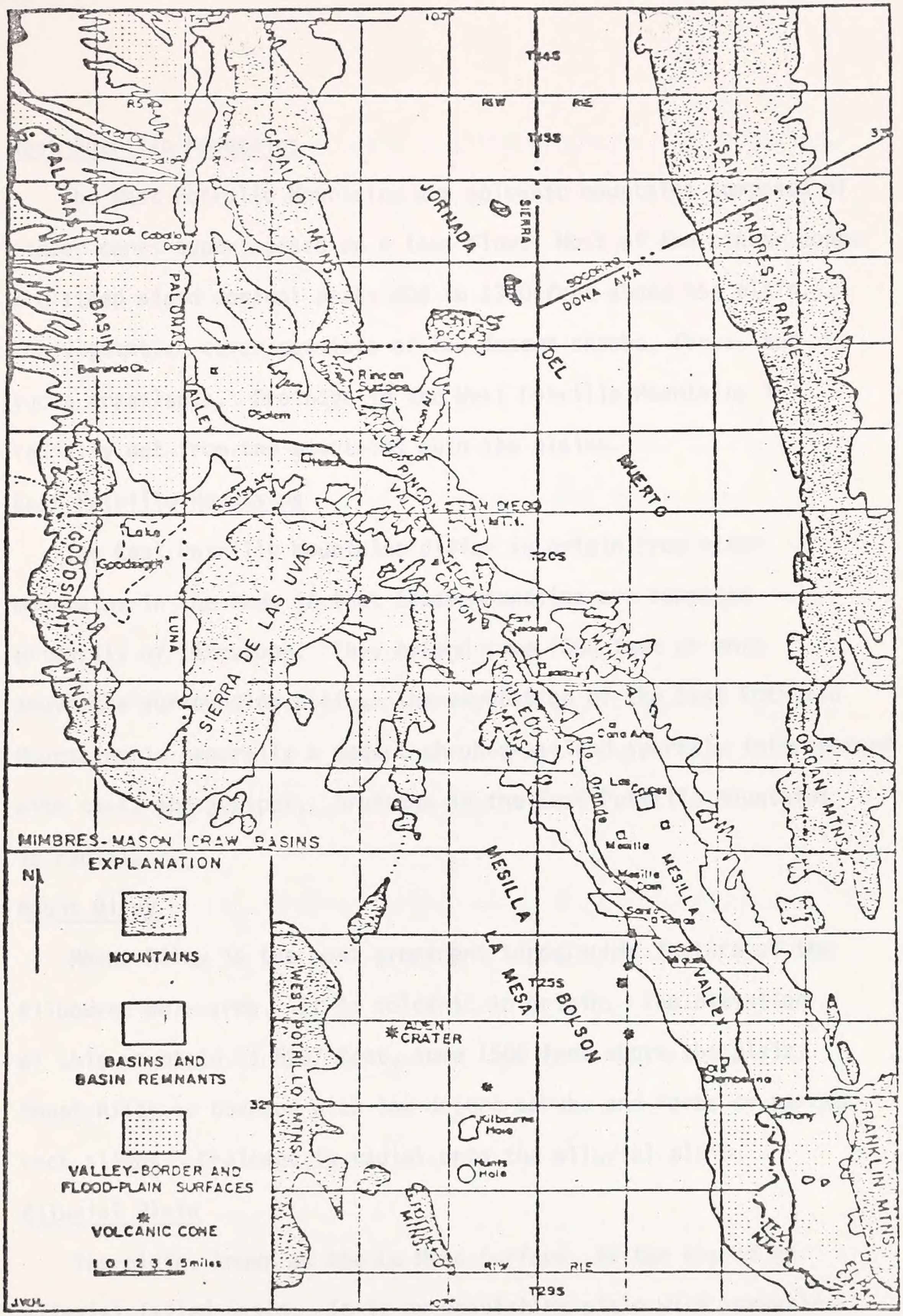
1. Adapted from original tables by Houghton, Frank E., 1972, Climatic Guide New Mexico State University, Las Cruces, New Mexico 1851-1971 Agricultural Experiment Station Research Report 230; New Mexico State University, Las Cruces, New Mexico 20p.



Taken from New Mexico Geological Society Sixteenth Field Conference Guidebook 1965.

PHYSIOGRAPHIC FEATURES OF THE PROPOSED LEASE AREA

Illustration 18

West Potrillo Mountains

The West Potrillo Mountains are volcanic mountains composed of cinder cones superimposed on a lava flow. Most of the cinder cones are steep sided conical peaks 800 to 1300 feet above the plain. The vegetative cover consists of low desert shrubs, forbs, and yucca grasslands. Drainage in the West Potrillo Mountains is radially out from the mountains onto the plains.

East Potrillo Mountains

The East Potrillo Mountains differ in origin from other mountains in the area in that these mountains are composed primarily of limestone. They extend some 1000 feet or more above the surrounding plain. The vegetation of the East Potrillo Mountains is generally a desert shrub-grassland sparsely interspersed with cacti and juniper. Drainage in the East Potrillo Mountains is radial.

Mount Riley

Mount Riley is the most prominent topographic feature of the Kilbourne Hole area. It is volcanic in origin. The elevation of this mountain is 5957 feet, some 1500 feet above the plain. Mount Riley is covered with low desert shrubs and forbs or barren rock slides. Drainage is radial onto the alluvial plain.

Alluvial Plain

The plain, known as the La Mesa Surface, is the top of an alluvial filled basin. It is an undulating plain with variable soil types. These soils are covered by grasslands, desert shrubs

associated with desert pavement, and desert shrubs associated with sand dunes. Small arroyos are present in the area, but due to the numerous crater-like structures, most of the drainage is internal. External drainage is present only along the east edge of the plain when short dendrictic arroyos drain into the Rio Grande Valley (16).

Kilbourne, Hunts, and Phillip's Holes

Kilbourne, Hunts, and Phillip's Hole are crater-like formations found within the plain. Kilbourne Hole is the most prominent, being about two miles in diameter and 450 feet deep. Hunt's Hole is about one mile in diameter and 180 feet deep. Phillip's Hole is about two and one half miles in diameter and 50 feet deep. Kilbourne and Hunt's Holes are prominent features while Phillip's Hole is not as obvious. These structures are vegetated by desert shrub-grasslands, and all structures drain internally.

Aden Lava Flow

A basaltic lava flow is located north of Kilbourne Hole. This lava flow, known as the Aden Lava Flow, covers about 22,700 acres and is about 100 feet above the plain. Many small depressions are present due to the irregular surface of the lava. A very diverse number of plant species cover this area. The irregular porous surface provides for internal drainage.

Soils

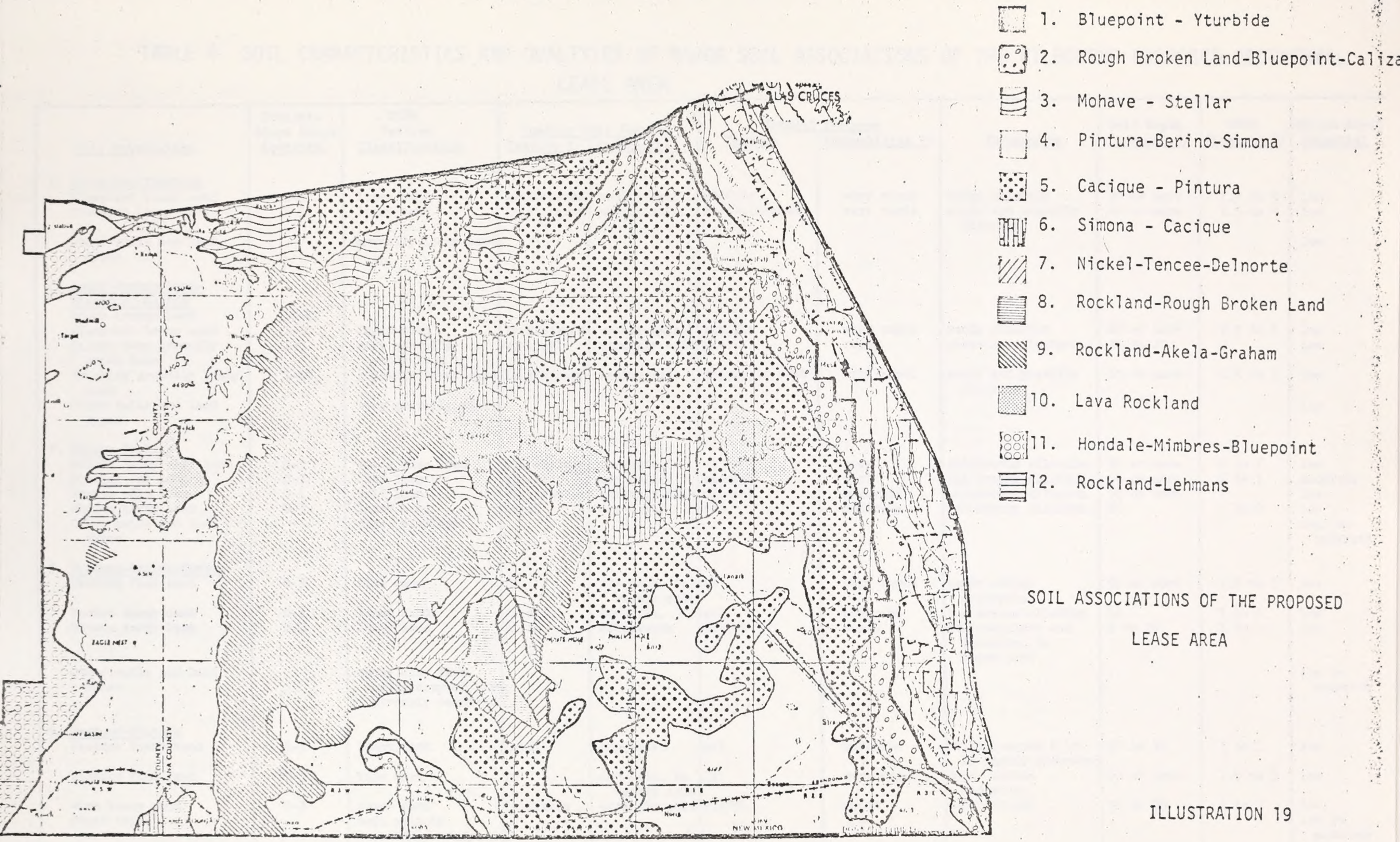
The Kilbourne Hole proposed lease area contains 12 soil associations. A discussion of their general characteristics, the soil series, and an interpretation of soil properties

considered important to analyze the various construction activities are presented in Appendix C. The soil associations are diagrammatically shown in Illustration 19. Soil characteristics and qualities of major soil series in each association of the proposed geothermal lease area presented in Table 4. Information within this table consists of the slope, USDA texture, subsurface texture and carbonates, subsoil texture and permeability, substratum, soil depth, available water holding capacity, and shrink-swell potential. Interpretations of soil properties for engineering use in the area are presented in Table 5. This table presents information on the suitability of soil as a source of top soil and roadfill, degree of limitation for septic tank filter fields, foundation support, locating highways, location reservoirs and constructing their embankments, and locating sanitary land fills.

Water

The Kilbourne Hole area is located in the Mesilla Bolson (a bolson is a flat desert valley surrounded by mountains which drain internally into shallow lakes and sinks). The broad flat floor of Mesilla Bolson is known as the La Mesa Surface, and contains no large perennial lakes. Stock tanks have been built in the area by ranchers and governmental agencies to help provide water for livestock.

The extreme eastern margin of the area drains into the Rio Grande River which is located immediately east of the area of consideration.



SOIL ASSOCIATIONS OF THE PROPOSED LEASE AREA

ILLUSTRATION 19

TABLE 4 SOIL CHARACTERISTICS AND QUALITIES OF MAJOR SOIL ASSOCIATIONS OF THE KILBOURNE PROPOSED GEOTHERMAL LEASE AREA

Soil Association	Dominate Slope Range (percent)	USDA Texture Classification	Surface Soil Features		Subsoil Features		Substratum	Soil Depth (inches) 5/	AWHC (inches) 6/	Shrink-Swell Potential
			Texture 2/	Carbonates	Texture	Permeability 4/				
1. Bluepoint-Yturbide										
Bluepoint loamy sand	1-5	loamy sand	ls;lfs;sand	weakly calc.	sand;ls	very rapid	sandy alluvium	60 or more	2.5 to 4	low
Yturbide loamy sand	1-5	loamy sand	ls;gls;sand	weakly calc.	gs;gls;ls;sand	very rapid	sandy and gravelly alluvium	60 or more	2.5 to 4	low
Other soils and land types		gravelly loamy sand								low
2. Rough Broken Land-Bluepoint-Caliza										
Rough broken land	15-50									
Bluepoint loamy sand	1-10	loamy sand	ls;lfs;sand	weakly calc.	sand;ls	very rapid	sandy alluvium	60 or more	2.5 to 4	low
Caliza very gravelly sandy loam	1-5	very gravelly sandy loam	vgsl;gsl	strongly calc	vgsl	rapid	gravelly alluvium	10 to 20	2	low
Yturbide gravelly loamy sand	1-10	gravelly loamy sand	ls;gls;sand	weakly calc.	gs;gls;ls;sand	very rapid	sandy and gravelly alluvium	60 or more	2.5 to 3	low
Other soils and land types		very gravelly sand								low
3. Mohave-Stellar										
Mohave sandy clay loam	0-3	sandy clay loam	scl;sl;loam	non-calc.	cl	slow	calcareous alluvium	60 or more	6 to 7	low
Stellar Jay loam	0-3	clay loam	cl;scl	non-calc.	clay;cl	slow	calcareous alluvium	60 or more	6 to 7	moderate
Reakor silt loam	0-1	silt loam	sil;loam	strongly calc	cl;sicl	moderate	calcareous alluvium	60 or more	7	low
Berino loamy sand	0-3	loamy sand	ls;sl	non-calc.	scl	moderate	calcareous alluvium	60	5 to 6	low
Other soils and land types		clay, clayloam								high to moderate
4. Pintura-Berino-Simona										
Pintura fine sand	0-3	fine sand	fs	non-calc. to weakly calc	fs	very rapid	sandy colian sediments	60 or more	2.5 to 3	low
Berino loamy sand	0-3	loamy sand	ls;sl	non-calc.	scl	moderate	calcareous alluvium	60	5 to 6	low
Simona sandy loam	0-3	loamy sand	sl;ls	calcareous	sl;fsl	rapid	caliche;platy and indurated in upper part	6 to 20	1 to 3	low
Other soils and land types		sandy clay loam caliche;upper part strongly cemented								low to moderate
5. Cacique-Pintura										
Cacique loamy sand	0-3	loamy sand	ls;sl	non-calc.	scl	moderate	caliche;upper 6 to 12 inches indurated	20 to 40	3 to 5	low
Pintura fine sand	0-3	fine sand	fs	non-calc. to weakly calc	fs	very rapid	sandy eolian sediments	60 or more	2.5 to 3	low
Wink loamy sand	0-3	loamy sand	ls;lfs;fs	strongly calc	sl;fsl	rapid	soft caliche	24 to 36	2 to 3	low
Other soils		soft caliche (sandy), sandy clay loam								low to moderate

TABLE 4 CONTINUED

Soil Association	Dominate Slope Range (percent)	USDA Texture Classification	Surface Soil Features		Subsoil Features		Substratum	Soil Depth (inches) 5/	AWHC (inches) 6/	Shrink-Swell Potential
			Texture 2/	Carbonates	Texture	Permeability 4/				
6. Simona-Cacique										
Simona fine sand loam	0-3	fine sandy loam	fsl;lfs	calcareous	fsl;sl	rapid	caliche;platy and undurated in upper part	6 to 12	1 to 2	low
Cacique sandy loam	0-3	sandy loam	sl;ls	non-calc.	scl	moderate	caliche;upper 6 to 12 inches;indurated	20 to 40	3 to 5	low
Tonuco loamy sand	0-3	loamy sand	ls;lfs	non-calc.	ls;lfs	rapid	caliche;indurated in upper part	10 to 20	1 to 2	low
Other soils and land types		caliche;upper part strongly cemented								
7. Nickel-Tencee-Delnorte										
Nickel gravelly sandy loam	0-10	gravelly sandy loam	gsl;gl	calcareous	gl;vgl	rapid	caliche;upper part weakly cemented	15 to 25	1 to 2	low
Tencee very gravelly loam	0-10	very gravelly loam	vgl;vgsl	strongly calc	vgl	rapid	caliche;platy and indurated in upper part	6 to 20	1 to 2	low
Delnorte very gravelly loam	0-10	very gravelly loam	vgl;vgsl	calcareous	vgl;vgsl	rapid	caliche;platy and indurated in upper part	6 to 20	1 to 2	low
Aladdin fine gravelly sandy loam	0-10	fine gravelly sandy loam	fgsl;fgls	non-calc.	fgsl	very rapid	fine gravelly alluvium	60 or more	4	low
Other soils and land types		very gravelly loam gravelly caliche; upper part strongly cemented caliche;strongly cemented in upper part								
8. Rockland-Rough Broken Land										
Rockland	15-75									
Rough broken land	15-60									
Lehmans rocky loam	10-35	stony loam	rl	non-calc.	stc;gc	very slow	igneous bedrock	10 to 20	2 to 3	moderate
Lozier stony loam	5-35	stony loam	stl	calcareous	stl;stcl	moderate	limestone bedrock	6 to 20	1 to 3	moderate
Other soils and land types		stony clay								moderate
9. Rockland-Akela-Graham										
Rockland	10-45									
Akela very gravelly sandy loam	0-10	very gravelly loam	vgsl;vgl	calcareous	gl;gscl	moderate	basalt bedrock	10 to 20	1 to 3	low
Graham stony loam	5-20	stony loam	stl	non-calc.	clay;stc	slow	basalt bedrock	15 to 20	2 to 3	low
Other soils and land types		clay (a few stones)								high
10. Lava Rockland										
Rockland	0-10									
Other soils										

TABLE 4 CONTINUED

Soil Association	Dominate Slope Range (percent)	USDA Texture Classification	Surface Soil Features		Subsoil Features		Substratum	Soil Depth (inches) 5/	AWHC (inches) 6/	Shrink-Swell Potential
			Texture 2/	Carbonates 3/	Texture	Permeability 4/				
11. Rockland-Lehmans										
Rockland	15-75									
Lehmans rocky loam	10-25	stony loam	rl	non-calc.	stcl;stc;gc	slow	acid igneous bedrock	10 to 20	2 to 3	moderate
Other soils		stony clay								moderate
12. Hondale-Mimbres-Bluepoint										
Hondale soils	0-1	loam	loam;sl;cl	calc.	clay;cl	very slow	loamy alluvium	60 or more	7	moderate
Mimbres silty clay loam	0-1	silty clay loam	sicl;loam	non-calc.	sicl;cl	slow	loamy alluvium	60 or more	8	moderate
Bluepoint loamy sand	0-3	loamy sand	ls;sand	weakly calc.	ls;sand	very rapid	sandy alluvium	60 or more	2.5 to 4	low
Other soils		clay;silty clay loam								moderate to high

1/ Adopted from original table by Maker, H. J. et al., 1971, Soil Association and Land Classification for Irrigation, Dona Ana County, Agricultural Experiment Station Research Report 183; New Mexico State University, Las Cruces, New Mexico and Maker, H. J. et al., 1970, Soil Association and Land Classification for Irrigation, Luna County, Agricultural Experiment Station Research Report 176; New Mexico State University, Las Cruces, New Mexico.

2/ Abbreviations used for textural classes:
fs - fine sand
lfs - loamy fine sand
ls - loamy sand
lvfs - loamy very fine sand
gs - gravelly sand
sl - sandy loam
fsl - fine sandy loam
gsl - gravelly sandy loam
vgsl - very gravelly sandy loam
fgsl - fine gravelly sandy loam
fgls - fine gravelly loamy sand
gl - gravelly loam
vgl - very gravelly loam
rl - rocky loam
stl - stony loam
c - clay
scl - sandy clay loam
gscl - gravelly sandy clay loam
sil - silt loam
sicl - silt clay loam

3/ calc. - calcareous

4/ Permeability class and approximate rates per hour:
very slow - less than 0.20 inches
slow - 0.20 to 0.63 inches
moderate - 0.63 to 2.50 inches
rapid - 2.50 to 6.30 inches
very rapid - more than 6.30 inches

5/ Depth in inches from surface of effective soil

6/ AWHC - Available water holding capacity (estimated to a depth of four feet or for effective soil material if less than four feet).

TABLE 5

INTERPRETATION OF SOIL PROPERTIES FOR ENGINEERING USES OF THE KILBOURNE HOLE PROPOSED GEOTHERMAL LEASE AREA

	Suitability as a Source of					Farms Ponds		
Soil Association	Topsoil	Road fill	Degree of limitation for Septic tank filter fields	Foundation Support	Highway Location	Reservoir Area	Embankment	Sanitary Landfills
1. Bluepoint-Yturbide								
Bluepoint loamy	Poor; very sandy and erodible	Good	Slight	Good bearing capacity; fair shear strength; low shrink-swell	Erodible when exposed on embankments	Very permeable: subject to seepage	Sandy & Erodible	Subject to wind erosion
Yturbide loamy sand	Poor; erodible some gravel	Good	Slight	Good bearing capacity and shear strength;low shrink-swell	-	Material too porous to hold water	Erodible & very permeable	Subject to wind erosion
2. Rough Broken Land - Bluepoing Caliza								
Rough Broken Land								
Bluepoint loamy sand	(See association 1)							
Caliza very gravelly sandy loam	Poor: gravelly; low fertility	Good if binder is added	Slight to Moderate	Good bearing capacity;low shrink-swell	Very gravelly Material	Material too porous to hold water	Gravelly & very permeable	Soil Features Favorable
3. Mohave - Stellar								
Mohave sandy clay loam	Surface 6 to 8 inches fair to good	Fair-moderate shrink-swell	Severe; slow permeability	Fair bearing capacity & shear strength; moderate shrink-swell	Fair bearing capacity; other features favorable	Good with compaction	Stable material when compacted	
Stellar	Surface 5 to 8 inches fair; clayey	Poor; plastic high to moderate shrink-swell	Severe; slow permeability subject to flooding	Fair to poor bearing capacity and shear strength;moderate to high shrink-swell	Plastic material; fair to poor bearing capacity	Soil features favorable	Clayey material; subject to cracking	Difficult to excavate when wet
Reakor Silt loam	Fair; moderately alkaline	Fair	Moderate; slow to moderate permeability	Fair bearing capacity and shear strength	Subject to some flooding	Moderate slow permeability: may require compaction	Very calcareous material; difficult to vegetate	Soil Features Favorable
4. Pintuea -Berino-Simona								
Pintura fine sand	Poor; very sandy erodible	Good	Slight to moderate occurs in form of coppice dunes over less permeable material.	Good if confined; needed to consider associated soils	Erodible sand; Duny with blowing and drifting sand	Unsuitable	Erodible and porous	Subject to wind erosion
Berino loamy sand	Poor; surface layers sandy and erodible	Fair material when mixed to a depth of about 3 feet.	Moderate, moderately permeable	Good bearing capacity and/shear strength; low to moderate shrink-swell	Erodible on exposed embankment; other features favorable	Moderately permeable, may require compaction	Erodible, fair stability when mixed and compacted	Soil Feature Favorable.
Simona	Poor; sandy and erodible	Good; upper part of caliche layer may require crushing	Severe; strongly cemented caliche at 10 to 20,inches	Good bearing capacity; caliche at 10 to 20 in. upper part cemented	Caliche at 10 to 20 in. upper part strongly cemented	Unsuitable	Unsuitable	Difficult to excavate Strongly cemented caliche at 10 to 20 in.
5. Cacique-Pintura								
Cacique	Poor, sandy and erodible	Fair	Severe, indurated caliche within a depth of 3 feet	Good bearing capacity and shear strength; indurated caliche at 20 to 40 inches	Indurated caliche between 20 and 40 inches	Moderately permeable subject to seepage if caliche is exposed	Fair stability if compacted; material limited	Moderately deep to indurated caliche
Pintura fine sand	(See association 4)							
Wink Loamy sand	Poor; calcareous; sandy and erodible	Upper 2 feet good fair below	Slight to moderate; caliche may restrict permeability	Good bearing capacity; fair to good shear strength; may be necessary to confine surface layers.	Erodible; some Loose and drifting sand.	Subject to seepage rapid to moderate permeability	Erodible surface layers; porous	Subject to wind erosion

TABLE 5 CONTINUED

Soil Association	Suitability as a Source of Topsoil	Suitability as a Source of Road fill	Degree of limitation for Septic tank filter fields	Foundation Support	Highway Location	Farms Ponds Reservoir Area	Farms Ponds Embankment	Sanitary Landfills
6. Simona-Cacique								
Simona fine sandy loam	Poor; sandy; erodible caliche fragments	Good; caliche may require crushing	Severe; indurated caliche at 6 to 12 in.	Indurated caliche at 6 to 12 inches	Sandy surface layers erodible; indurated caliche at 6 to 12 inches	Unsuitable	Unsuitable	Indurated caliche at 6 to 12 inches upper part difficult to excavate.
Cacique sandy loam	(See association 5)							
Tonuco loamy sand	Poor; sandy and erodible	Good; caliche below 10 to 20 inches may require crushing	Severe; indurated caliche at 10 to 20 inches	Indurated caliche at 10 to 20 inches	Erodible surface layers; shallow to indurated caliche	Unsuitable	Unsuitable	Indurated caliche at 10 to 20 inches; upper part difficult to excavate.
7. Nickel-Tencee-Delnorte								
Nickel gravelly, sandy loam	Poor; high gravel content	Good	Slight	Good bearing capacity and shear strength; low shrink-swell	Moderate sloping; some cuts and fills	Subject to seepage; permeable and gravelly	Gravelly and cobby material; fair stability if compacted.	Moderate slopes
Tencee very gravelly loma	Poor, clacareous; high gravel content.	Good caliche at 6 to 20 inches may require crushing	Severe: shallow to strongly cemented caliche	Good bearing capacity; shallow to caliche; indurated in upper part.	Moderate sloping; some cuts and fills; indurated caliche at 6 to 20 inches	Unsuitable	Gravelly and porous material; limited amount of material.	Moderate slopes; indurated caliche at 6 to 20 inches difficult to excavate.
Delnorte very gravelly loam	Poor; high gravel content	Good caliche at 6 to 20 inches; may require crushing	Severe; shallow to indurated caliche	Good bearing capacity; shallow to caliche; indurated in upper part.	Moderate sloping; some cuts and fills; indurated caliche at 6 to 20 inches.	Unsuitable	Gravelly and porous material; limited amount of material.	Moderate slopes; indurated caliche at 6 to 20 inches difficult to excavate.
8. Rockland-Rough Broken Land	(Interpretation not made)							
Lehmans Rocky loam	Poor, stony	Poor; plastic and moderate shrink-swell; limited material.	Severe; shallow to bedrock	Good; shallow to bedrock	Steep slopes; rock outcrops; limited borrow materials.	Unsuitable	Unsuitable	Unsuitable; shallow to bedrock.
9. Rockland-Akela-Grahm								
Akela very gravelly sandy loam.	Poor, gravelly	Fair material limited	Severe; shallow to bedrock.	Good bearing capacity; bedrock at 10 to 20 inches.	Cobbles and gravel; shallow to bedrock.	Unsuitable	Unsuitable	Shallow to bedrock
Graham stony loam	Poor; high stone content	Poor; plastic; high stone content and limited material	Severe; shallow to bedrock.	Bedrock at 15 to 20 inches.	High stone content and shallow to bedrock	Unsuitable	Unsuitable	Shallow to bedrock
10. Lava Rockland Rockland	(No interpretation made)							
11. Rockland-Lehmans Rockland	(No interpretation made)							

TABLE 5 CONTINUED

	Suitability as a Source of		Degree of limitation for			Farms Ponds		
oil Association	Topsoil	Road fill	Septic tank filter fields	Foundation Support	Highway Location	Reservoir Area	Embankment	Sanitary Landfills
Lehmans rocky loam	Poor; stony and clayey	Poor; limited amount of material; plastic; stones.	Severe; shallow to bedrock.	Shallow to bedrock	Steep slopes; rock outcrops; limited amount of borrow material	Unsuitable	Limited amount of material; clayey and stony	
12. Hondale-Mimbres-Bluepoint								
Hondale Loam	Poor; often alkali affected	Poor; very unstable moderate to high shrink-swell.	Severe; very slow permeability	Fair bearing capacity and shear strength; moderate to high shrink-swell	Unstable and plastic material.	Favorable	Poor stability; subject to cracking; erodible	
Mimbres silty clay loam.	Surface 8 to 80 inches fair; clayey	Poor; moderately plastic materials	Severe; slow permeability.	Fair bearing capacity; moderate to high shrink-swell.	Plastic material; subject to occasional flooding.	Favorable	Clayey material; subject to cracking.	
Bluepoint loamy Sand	(See association)							

1. Adopted from original table by Maker, H.J. et al 1971, Soil association and land classification for irrigation, Dona Ana County, Agricultural Experiement Station Research Report 183; New Mexico State University, Las Cruces, New Mexico and Maker, H.J. et al., 1970, Soil association and land classification for irrigation, Luna County, A-ricultural Experiment Station Research Report 176; New Mexico State University, Las Cruces, New Mexico.

Ground water on the La Mesa Surface is derived mainly from precipitation which falls on areas of lava outcrops, and from along the mountain fronts where drainages carry the runoff onto the plains. Only in exceptionally wet years can an appreciable amount of precipitation on the plains be expected to reach the water table. Normally, most of the precipitation evaporates or is transpired by plants. The depth to the water table varies throughout the area (see Illustration 20).

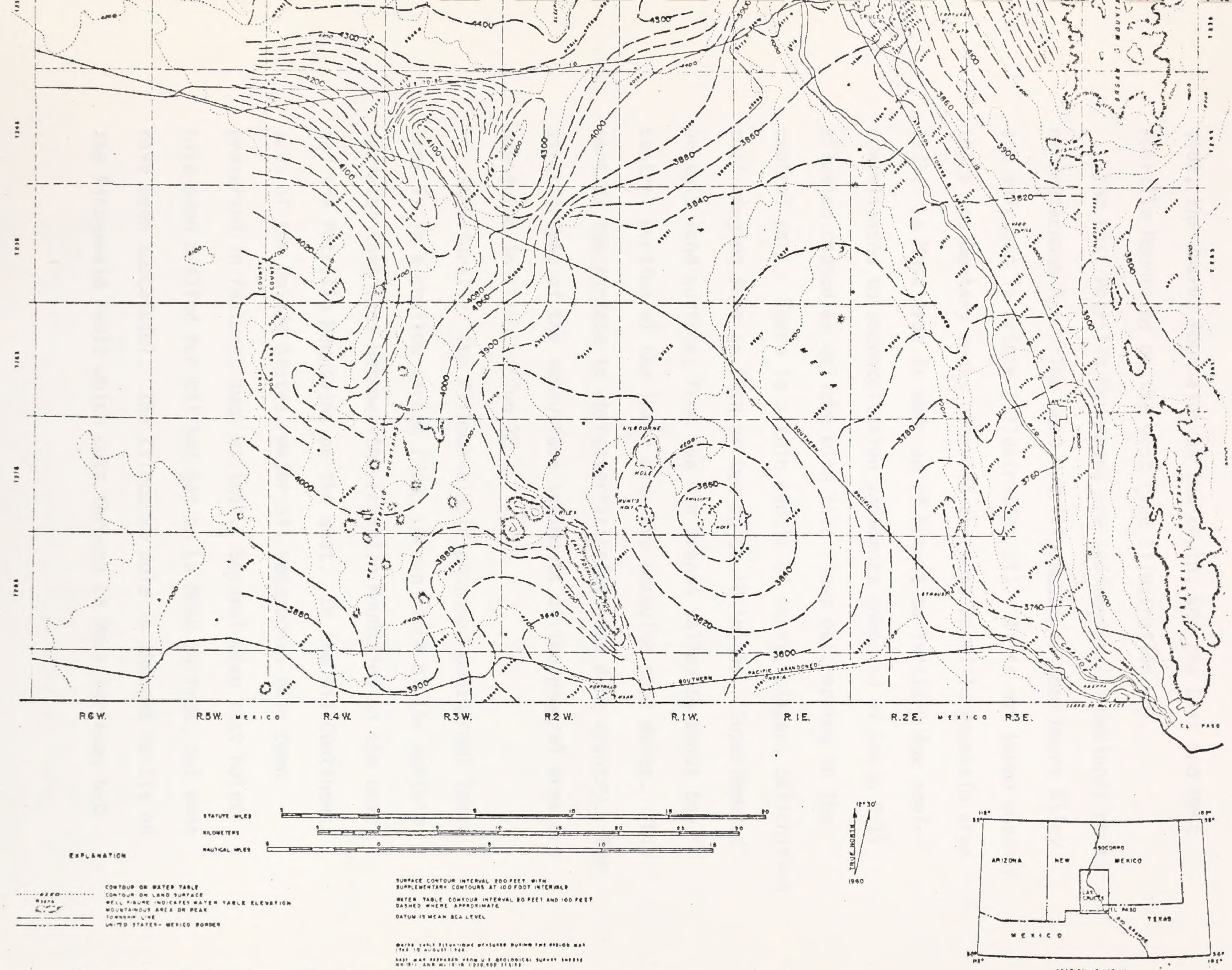
Attempts have been made to initiate irrigation farms on the La Mesa Surface, but the ventures have been unsuccessful. Water wells in the area are used mainly to water livestock.

Studies indicate that ground water levels have not been lowered appreciably in many areas since 1954. The output of wells on La Mesa are much lower than those in the Rio Grande Valley to the east (13).

Chemical analyses are not available on water quality for the entire area, but in general the water is considered to be of good quality in most places. A well was drilled in Kilbourne Hole to a depth of 179 feet and was reported to have recovered warm sulphur water.

Geology

The Kilbourne Hole area is located generally on the western part of the La Mesa Surface. La Mesa Surface is bounded on the north by the Sierra de Las Uvas Mountains, on the northeast by the Robledo Mountains, the Rio Grande Valley along the eastern



Taken from WRRI Report #6, June 1969, New Mexico State University

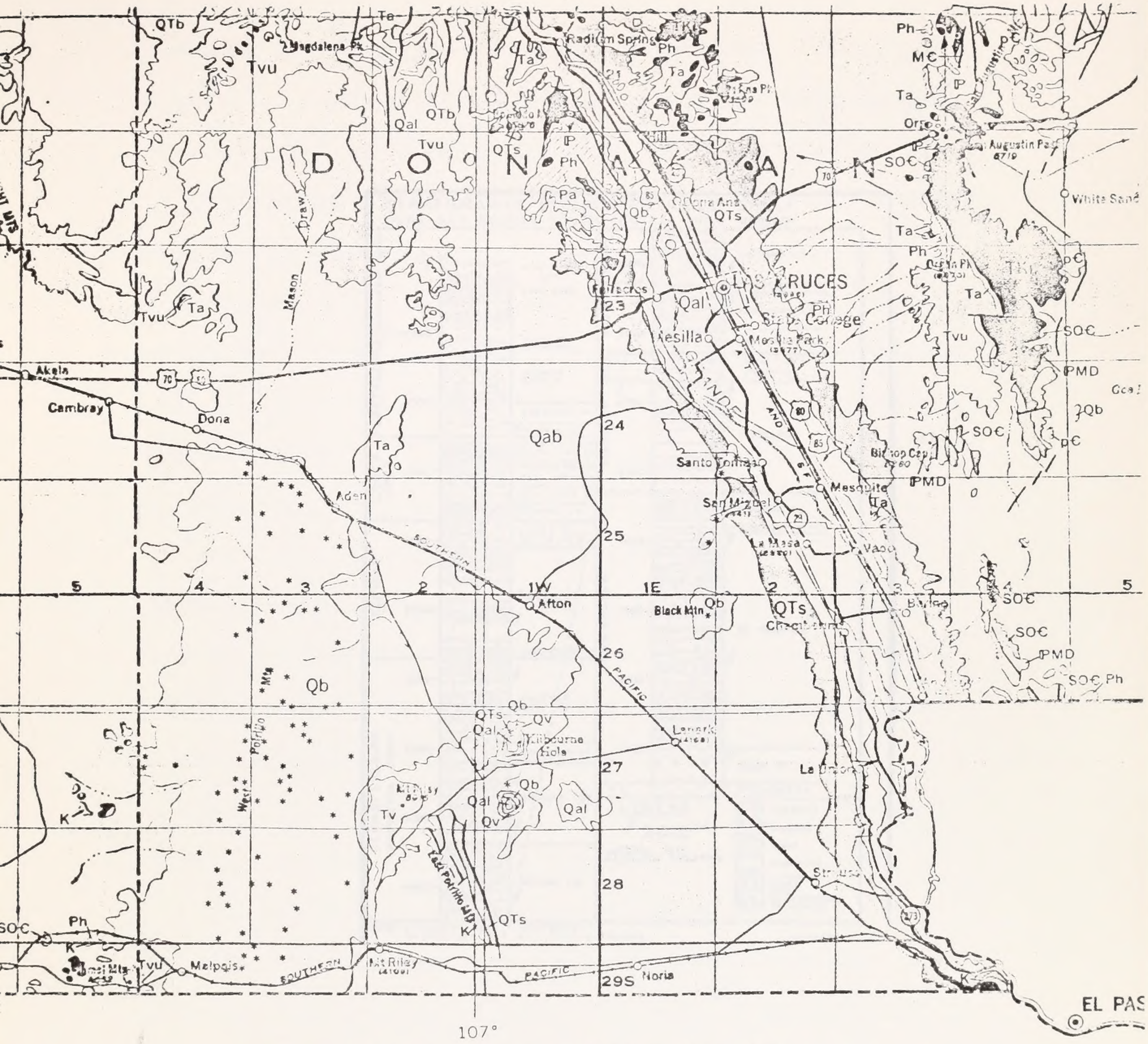
LAND-SURFACE AND WATER-TABLE CONTOURS IN THE RIO GRANDE VALLEY

Illustration 20

side, the Juarez Mountains on the south, and the East and West Potrillo Mountains on the west (see Illustration 18).

The East Potrillo Mountains are sedimentary (limestone) rocks of Cretaceous Age. The West Potrillo Mountains and Mount Riley are volcanic in origin (Illustration 21). It is not known whether thick sedimentary rocks underlie the West Potrillo Mountain area (13). La Mesa area is made up of Recent to Tertiary Age semi-consolidated to unconsolidated sediments composed of basin fill alluvium capped by caliche with lava flows outcropping in the central part. There is a thin mantle of sandy, clayey, calichified soil ranging from an inch or two up to 18 inches. Superimposed on this land surface, from the Rio Grande Valley to about the central portion of the lease area are mesquite sand dunes. This part of the surface is characteristically sand dune country. The stratigraphy of the subsurface sediments of the general area are presented in Illustration 22.

Structurally, the Kilbourne Hole proposed geothermal lease area is in a shallow garben (down thrown block of the earth's surface) that lies between the Franklin Mountains on the east and the Potrillo Mountains on the west. In the Mid-Continent area of the United States, major oil reservoirs have been preserved in features such as this. Several deep test holes have been drilled for oil and gas on La Mesa Surface, but none have been successful. The Kilbourne Hole is thought to lie on the Fitzgerald Fault which cuts through La Mesa Surface, but



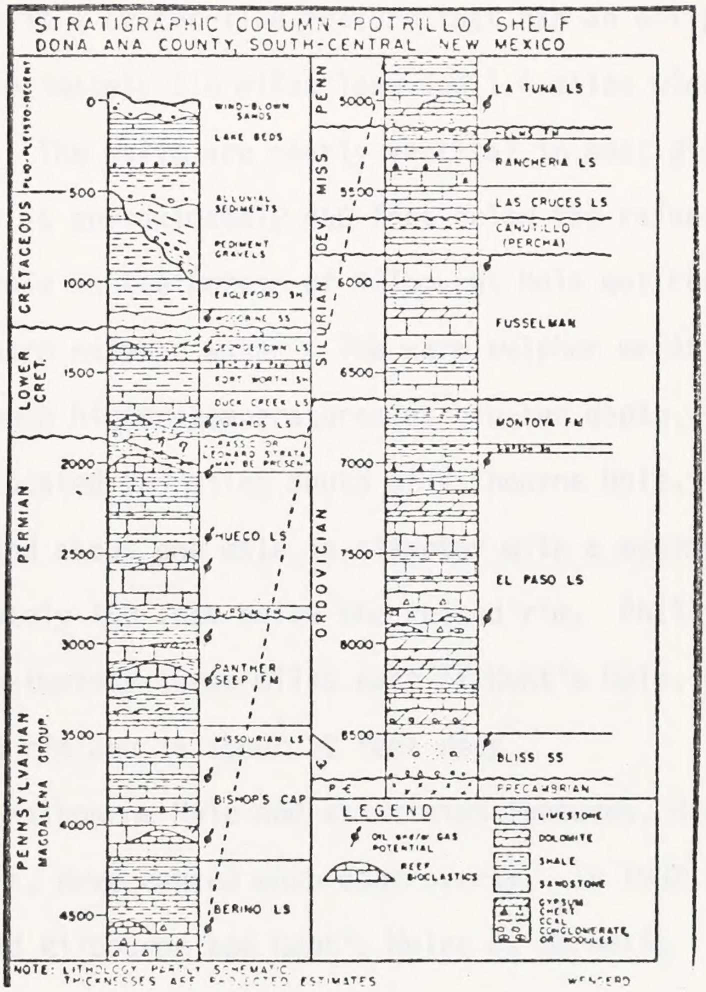
GEOLOGIC MAP OF KILBOURNE HOLE AREA

General Rock Descriptions

Qab - Alluvium & Bolson Deposits
Qal - Alluvium
Qb - Basalt Flows
Qts - Santa Fe Group - Volcanic Rock
Qv - Volcanic Rock
Ta - Volcanic Rock
Tki - Intrusive Rock

: Tuv - Volcanic Rock
: Tv - Extrusive Rock
: Pa - Abosandstone
: Ph - Hueco Limestone
: IP - Pennsylvanian Age Rock
: SOC - Silurian, Ordovician and Cambrian
: * - Volcanic Vents

ILLUSTRATION 21



Taken from New Mexico Geological Society-Twentieth Field Conference Guidebook, 1969.

STRATIGRAPHIC COLUMN OF THE KILBOURNE HOLE AREA

ILLUSTRATION 22

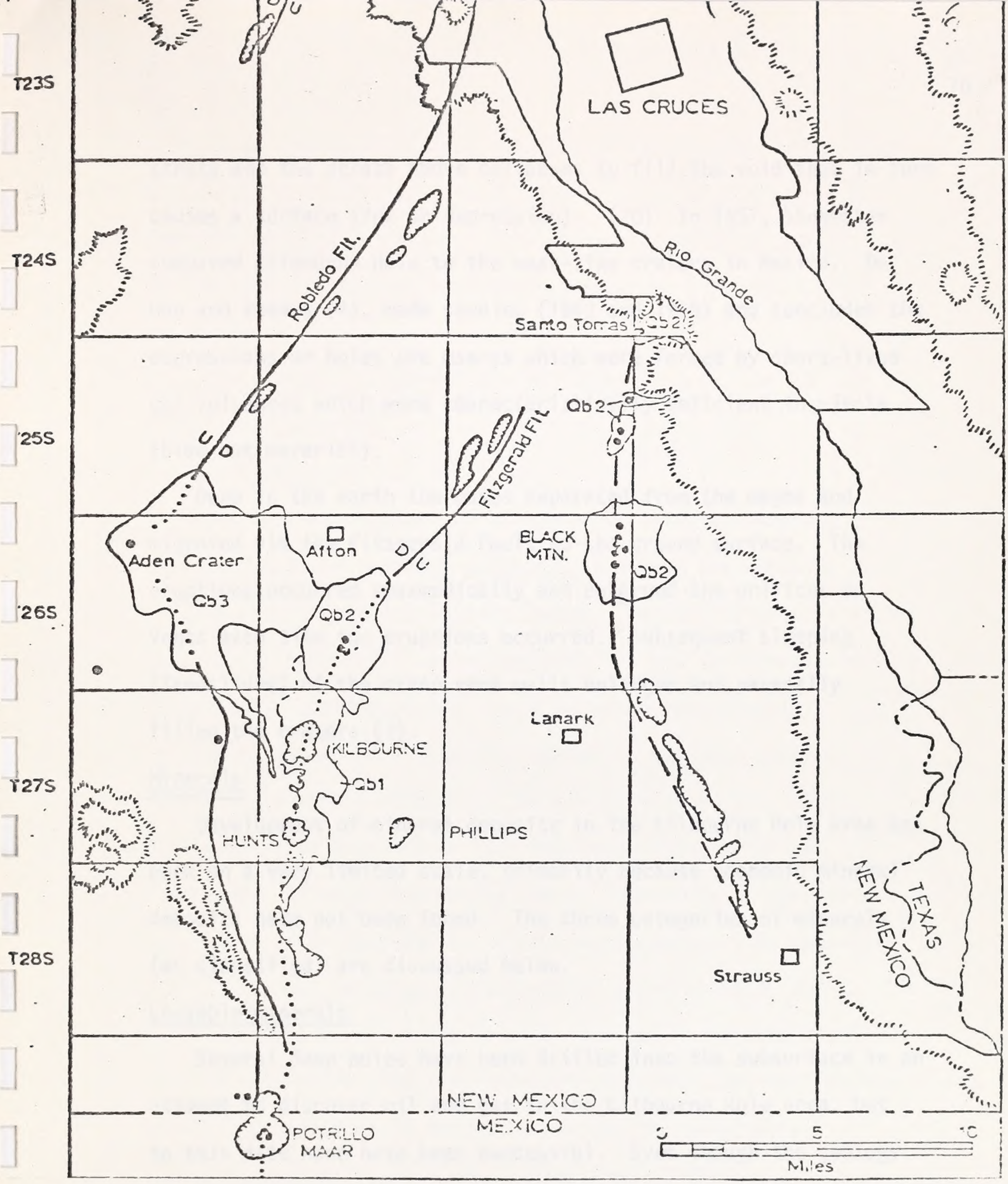
is obscure in this region due to surface sediments. The alignment of cinder cones and depressions suggests these features are structually controlled by the fault (3)(Illustration 23.)

Kilbourne Hole is a crater-like feature that has an elliptical shape that is approximately 2.0 miles long and 1.4 miles wide (Illustration 18). The walls are nearly vertical in most places and the flat floor is approximately 450 feet below the raised rim. A 179 foot drill hole in the bottom of Kilbourne Hole was reported to have produced warm sulphur water. The warm sulphur water could be indicative of much higher temperatures at greater depth.

Hunt's Hole, located two miles south of Kilbourne Hole, is roughly circular and about one mile in diameter with a maximum depth of approximately 180 feet below the raised rim. Phillip's Hole located approximately three miles east of Hunt's Hole, has no sharply defined rim and is about 50 feet deep.

The origin of Kilbourne Hole and associated features, Hunt's, and Phillip's Holes, have caused much controversy. In 1907, W. T. Lee described Kilbourne and Hunt's Holes as phreatic explosion pits which were caused when the ground water was converted to steam by an intruding dike (14). Also, Kilbourne Hole was inlcuded in an article on explosion pits of the southwest by Darton (2).

In 1940, Reiche proposed solution collapse as the origin of Kilbourne Hole (solution collapse for example happens when a soluble material such as salt is leached from the subsurface



Taken from New Mexico Geological Society-Sixteenth Field Conference Guidebook, 1965.

Index map of La Mesa showing faults (solid lines, dashed where probable, dotted where uncertain), basalt flows (Qb), and volcanic cones (large dots).

ILLUSTRATION 23

strata and the strata above collapses to fill the void that in turn causes a surface sink or depression) (20) In 1957, Shoemaker compared Kilbourne Hole to the maar-like craters in Mexico. De Hon and Reeves (4), made studies (1963 and 1965) and concluded the depressions or holes are maares which were formed by short-lived gas volcanoes which were characteristically deficient in ejecta (blow out material).

Deep in the earth the gases separated from the magma and migrated via the Fitzgerald Fault to the ground surface. The eruptions occurred spasmodically and enlarged the orifices or vents each time the eruptions occurred. Subsequent slumping (landslides) of the steep vent walls enlarged and partially filled the craters (3).

Minerals

Development of mineral deposits in the Kilbourne Hole area has been on a very limited scale, primarily because economic mineral deposits have not been found. The three categories of minerals (as classified) are discussed below.

Leasable minerals

Several deep holes have been drilled into the subsurface in an attempt to discover oil and gas in the Kilbourne Hole area, but to this date none have been successful. Even though the geology appears to be favorable, reportedly few indications of oil and gas have been observed.

The area is thought to have potential for geothermal resource

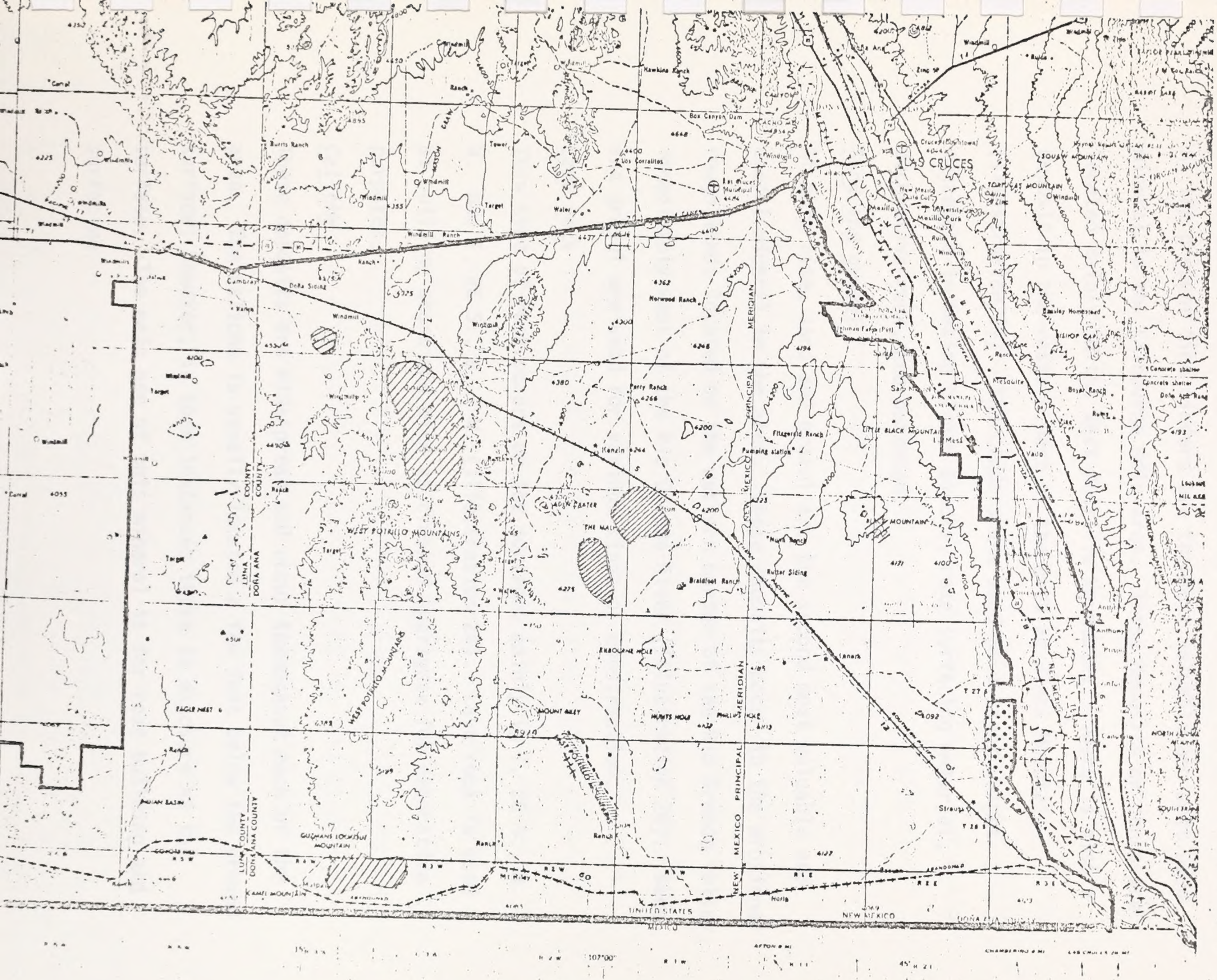
because of recent volcanism, recovery of warm sulphur water from a shallow well (179 feet) in Kilbourne Hole, and crater-like features which are present. Also, one of the wildcat wells drilled for oil and gas supposedly discovered abnormally high temperatures.

Other leasable minerals are not known to occur in the Kilbourne Hole area.

Locatable minerals

These minerals appear to be very restricted in occurrence in the area; however, barite, manganese, and lead are known to be present in the East Potrillo Mountains. Mining claims have been located on these small, scattered deposits but the mineral content is presently considered too low to be mined economically.

Mining claims have also been staked in the East Potrillo Mountains on marble deposits. The marble occurs in a rather small localized area where there has been metamorphism of limestone. Color of the marble varies from white to gray and has little or no textural or coloration features. The deposit may not be massive enough for dimension stone suitable for building purposes; however, in chip form the marble could be used as decorative rock for landscape purposes. The quality and use of the marble would determine whether the material was locatable or a saleable mineral (Illustration 24).



LEGEND
Mineral Deposits*

- ▨ Cinders
- ▨ Sand & Gravel
- ▨ Lava Rock
- ▤ Limestone
- ▨ Barite, Lead and Manganese
- ▨ Marble

*Approximate location deposits.

ILLUSTRATION 24

Saleable minerals

Volcanic cinders

At the present time cinders are the most valuable and most used mineral in the Kilbourne Hole area. These deposits or cones are located mainly in the West Potrillo Mountains. There is also a deposit in the eastern part of the area at Black Mountain (Illustration 24). The cinders are used as a light weight aggregate in making cinder blocks, road surfacing material, decorative rock, and pozzolan.

Sand and gravel

At this time, sand and gravel are the second most valuable and useful mineral in the area. These deposits occur in the erosional rough lands located on the western border of the Rio Grande Valley, immediately west of the Rio Grande River (Illustration 24). Sand and gravel are used for various kinds of construction.

Lava rock

This type of rock occurs on the surface, mainly in T. 26 S., R. 1 W. and T. 26 S., R. 2 W. (Illustration 24). Lava rock is used as building stone and also as crushed aggregate for decorative purposes.

Caliche

These deposits are widespread and occur throughout much of the area. The caliche is usually located a few feet below the ground surface; however, in some instances there is exposure at the surface. The main use of this mineral is for road building and surfacing.

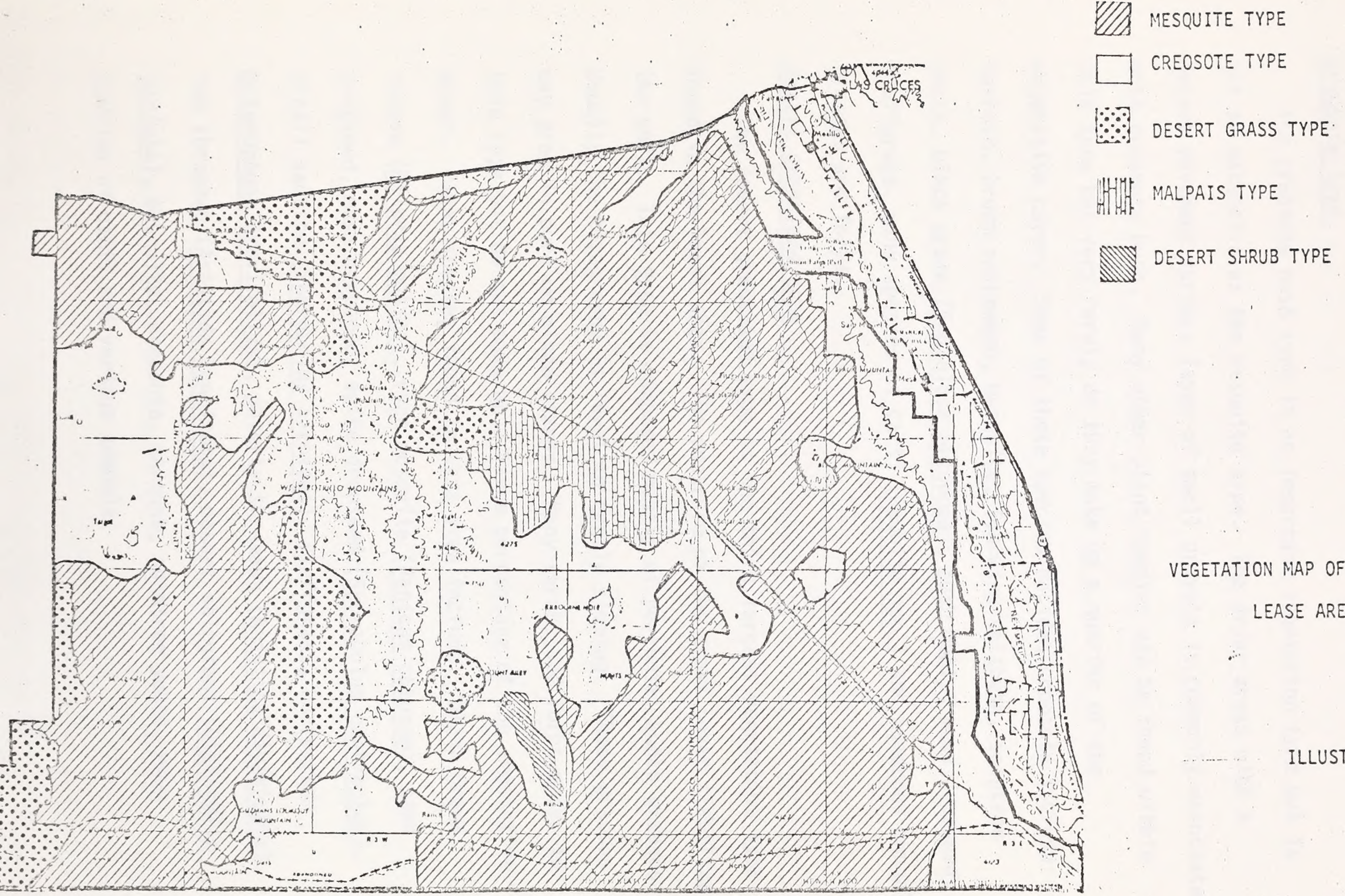
Living Components

Vegetation

The area is classified as a desert grassland (7). Thornbury (25) considers this region as part of the Mexican Highland Section of the Basin and Range Province. This desert grassland varies throughout the area and is therefore broken into five vegetation types which are: mesquite (*Prosopis juliflora*), creosote (*Larrea tridentata*), grassland, desert shrub, and the malpais. Vegetation within each of these types varies due to the soils, elevation, exposure, temperature, and precipitation (Illustration 25).

Mesquite type

The mesquite type is the most widely distributed vegetation type found in the proposed geothermal lease area. The dominant shrub is mesquite. Loose sandy soils accumulate around the base of mesquite plants, thus producing a microrelief of sand dunes. The dunes may be composed of other co-dominant desert shrubs. The interdunes are either barren or support a sparse community of annual and perennial vegetation. Some plant species found in this vegetation type besides mesquite are: fourwing saltbush (*Atriplex canescens*), broom snakeweed (*Gutierrezia sarothrae*), soaptree yucca (*Yucca elata*), creosote bush, tarbush (*Flourensia cernua*), sand dropseed (*Sporobolus cryptandrus*), mesa dropseed (*Sporobolus flexuosus*), bush muhly (*Muhlenbergia porteri*), fluffgrass (*Tridens pulchellus*), and many annual grasses and forbs.



VEGETATION MAP OF THE PROPOSED
LEASE AREA

ILLUSTRATION 25

Creosote type

The creosote bush type is an important vegetation type but is not as extensive as the mesquite type. The drier areas with a desert pavement surface layer of small gravels is commonly associated with creosote bush. Many other plant species may be found within this type but very rarely do they make up a quarter of the vegetative cover. Some of these species besides creosote include: tarbush, broom snakeweed, mesquite, fourwing saltbush, soaptree yucca, black grama (*Bouteloua eriopoda*), bush muhly, mesa dropseed, fluffgrass, many species of cacti (*Opuntia spp.*) and numerous annual grasses and forbs.

Desert grassland type

The desert grassland type is the third largest vegetation type found in the lease area. The presence of the grass cover stabilize the soil. This type is composed mostly of perennial bunch grasses. Usually the topography is level to gently sloping. These grasses may grow in pure or mixed stands. Many shrubs and forbs occur in this type but do not make up a large percentage of the vegetative cover. Plant species found in this area include: black grama, tobosa (*Hilaria mutica*), vine mesquite (*Panicum obtusum*), sand dropseed, mesa dropseed, spike dropseed (*Sporobolus contractus*), alkali sacaton (*Sporobolus airoides*), fluffgrass, burrograss (*Scleropogon brevifolius*), poverty threeawn (*Aristida divaricata*), red threeawn (*Aristida longiseta*), desert saltgrass (*Distichlis stricta*), mesquite, creosote, tarbush, soaptree yucca, many species of cacti and various annuals.

Desert shrub type

The desert shrub type is found in the East Potrillo Mountains. Many different species are found in this area but no one species dominates. These species may include: one-seed juniper (*Juniperus monosperma*), shrub liveoack (*Quercus turbinella*), wolfberry (*Lycium berlandieri*), Apache plume (*Fallugia parodoxa*), soaptree yucca, Torries yucca (*Yucca torrei*), desert willow, (*Chilopsis linearis*), creosote, and various species of cacti, black grama, sideoats grama (*Bouteloua curtipendula*), blue grama (*Bouteloua gracilis*), bush muhly, Indian ricegrass (*Orizopsis hymenoides*), little bluestem (*Schizachyium scoporium*), sand dropseed, poverty threeawn, red threeawn, and many annual grasses and forbs.

The Malpais type

The malpais type is a unique type found within the lava flow north of Kilbourne's Hole. This area consists of sandy loam, silt loam, and exposed lava surfaces. Many depressions are found. The surface configuration of this area helps concentrate water into the lower areas. This increase in water produces a large variety of vegetative species. Some of these species may include: mesquite, creosote, tarbush, fourwing saltbush, soaptree yucca, Apache plume, wolfberry, one-seed juniper, various species of cacti, tobosa, vine mesquite, black grama, sideoats grama, blue grama, sand dropseed, spike dropseed, mesa dropseed, bush muhly, red threeawn, poverty threeawn, alkali sacaton, fluffgrass,

burrograss, and various annual forbs and grasses. A detailed vegetative study is needed to assess the botanical value of this area.

Vegetational variations due to soils

Vegetation and plant communities vary due to changes in soil characteristics. Various soil properties such as depth, texture, composition, and nutrient properties influence the amount and type of vegetation produced on these soils. Ecotones are very abrupt in some areas and not in others.

Vegetative variations due to elevation

Elevation has an influence on the species composition of this area. The plain is at about 4,000 feet while the mountains range up to 6,000 feet. Temperatures are cooler and precipitation increases with elevation (16). Shrubs dominate the plain at 4,000 feet. Shrubs are replaced by grasses with elevations up to 5,000 feet. The higher elevations are composed of grasses in association with some shrubs and forbs (8).

Vegetative variations due to exposure

Exposure produces some variations in vegetation. The plain has very little relief and no real slope exposures. Therefore, little variation occurs due to exposure. In the rougher areas of the foothills and mountain slopes exposure does produce variations. The south exposures are hot and dry, thus producing a different species composition in relation to the north slopes which are slightly cooler and wetter. This effect is dramatically

displayed in the East Potrillo Mountains and on Mount Riley where relict stands of one-seed juniper can still be found on north facing slopes.

Vegetation in relation to watershed

Vegetation influences the stability of soils. Wind and water erosion vary within each type.

The mesquite type is more commonly associated with loose sandy soils. Sites dominated by mesquite are often characterized by great amounts of soil particles accumulated under the mesquite plants, with erosion between plants so severe that subsurface soils (caliche) are often exposed. This shows that mesquite does effectively intercept large amounts of blowing sand, thus producing some stability on these, otherwise highly erodable soils. Water erosion is probably common but due to the level topography and internal drainage has not been proven to be a major problem in this area.

The creosote bush type is usually associated with soils that contain a gravelly surface layer (desert pavement). These soils are on drier upland sites. Soils associated with this type are normally stable due to desert pavement and vegetation. Creosote bush contributes to soil stability by reducing wind velocity at the soils surface. If however, the surface is disturbed, fine particles are exposed and subject to both wind and water erosion.

The grassland type is found on the heavier more stable soils. These soils are found in the swales and on mountain slopes with

a rock mixture (8). Perennial grasses help stabilize these soils due to their growth, form, and dense vegetative cover. These soils are not usually exposed to wind and water erosion and therefore very little soil is lost. If the cover is broken for some reason erosion will take place. The desert shrub and malpais types are composed of rocky soils that produce little or no soil erosion.

Animals

Domestic

Covered under land uses.

Wildlife

A variety of wildlife species are found throughout the proposed geothermal lease area. Several species are restricted in distribution due to specialized habitat requirements while others occur throughout the lease area. Difference in soils vegetation and topography and their influence on microclimate may in part produce these limitations. Large mammals such as mule deer (*Odocoileus hemionus*), coyotes (*Canis latrans*), and bobcats (*Lynx rufus*) are found in the area but they are relatively few in number as compared to smaller animals. Populations of small mammals are high in the mesquite types (Table 6). A variety of bird species are found throughout the lease area and both species and number vary throughout the year (Table 7). According to available data, no fish are present within the lease area to our knowledge. Reptiles, amphibians, and numerous invertebrates

TABLE 6 SEASON OF USE AND ANIMALS FOUND IN THE UPPER SONORAN LIFE ZONE

Class of Animals	Common Name	Scientific Name	Season Of use	Classification 1/	Remarks
MAMMALS	Gray Shrew	Notiosorex crawfordi	YL		Chaparral slopes
	Leafnose Bat	Macrotus californicus	M-S		Caves, old mine tunnels
	Little Brown Myotis	Myotis lucifugus	M-S		Mine tunnels, caves, buildings
	Yuma Myotis	Myotis yumanesis			Caves, tunnels, buildings
	Cave Myotis	Myotis velifer	M-S		Caves, tunnels, buildings
	Arizona Myotis	Myotis occultis	M-S		Buildings, mine tunnels
	Fringed Myotis	Myotis thysanodes	M-S		Caves & attics of old buildings
	Long-legged Myotis	Myotis volano	M-S		Buildings
	California Myotis	Myotis californicus	M-S		Mine tunnels, hollow trees, loose rocks, buildings
	Small-footed Myotis	Myotis subulatus	M-S		Caves, mine tunnels, crevices in rocks and buildings
	Silver-haired Bat	Lasionycteris noctivagan	M-S		Forested areas, buildings, caves
	Western Pipistrel	Pipistrellus hesperus	M-S		Caves, under loose rocks, crevices in cliffs, near water
	Big Brown Bat	Eptesicus fuscus	M-S		Caves, tunnels, crevices, hollow trees, wooded areas
	Hoary Bat	Lasiurus cinereus	M-S		Wooded areas
	Spotted Bat	Euderma maculata	M-S	Rare	Arid country
	Western Big-eared Bat	Plecotus townsendi	M-S		Caves, mine tunnels, buildings
	Palid Bat	Antrozous pallidus	M-S		Caves, mine tunnels, rock crevices, trees
	Mexican Freetail Bat	Tadarida brasiliensis	M-S		Caves & buildings for roosts, feeds mainly on moths
	Big Freetail Bat	Tadarida molossa	M-S		Caves, crevices in cliffs, buildings
	Black Bear	Ursus americanus	YL	Game	Mountainous areas
	Raccoon	Procyon lotor	YL	Furbearer	Along streams and lake borders
	Ringtail	Bassariscus astutus	YL	Furbearer	Chaparral, rocky ridges & cliffs near water

TABLE 6 SEASON OF USE AND ANIMALS FOUND IN THE UPPER SONORAN LIFE ZONE

Class of Animals	Common Name	Scientific Name	Season Of use	Classification 1/	Remarks
MAMMALS	Badger	Taxidea taxus	YL		Open grasslands & deserts, foothill areas
	Spotted Skunk	Spilogale putorius	YL	Furbearer	Brushy or sparsely wooded areas near streams among boulders
	Striped Skunk	Mephitis mephitis	YL	Furbearer	Semi-open country, mixed woods, brushland & open prairie
	Hooded Skunk	Mephitis macroura	YL	Furbearer	Along streams and rocky ledges
	Hognose Skunk	Conepatus leuconotus	YL	Furbearer	Partly wooded, brushy, rocky areas
	Coyote	Canis latrans	YL		All habitats
	Red Fox	Vulpes fulva	YL	Furbearer	Mixture of forest & open country
	Kit Fox	Vulpes macrotis	YL	Furbearer	Open, level,sandy ground
	Gray Fox	Urocyon cinereoargenteus	YL	Furbearer	Chapparral, open forests. rimrock
	Mountain Lion	Felis concolor	YL	Game	Chaparral, open country, rimrock
	Bobcat	Lynx rufus	YL		Rimrock & chaparral areas
	Rock Squirrel	Citellus variegatus	YL		Rocky conyons & boulder-strewn slopes
	Spotted Ground Squirrel	Citellus spilosoma	YL		Open forests, sandy soil
	Cliff Chipmunk	Eutamias dorsalis	YL		Pinon pine, juniper slopes
	Valley Pocket Gopher	Thomomys bottae	YL		Valleys & mountain meadows
	Plains pocket Gopher	Geomys bursarius	YL		Grassy prairies, brushy areas
	Silky Pocket Mouse	Perognathus flavus	YL		Short grass prairies
	Apache Pocket Mouse	Perognathus apache	YL		Sparse brush, scattered junipers or pines
	Rock Pocket Mouse	Perognathus intermedius	YL		Rocky slopes, sparse vegetatio
	Bannertail Kangaroo Rat	Dipodomys spectabilis	YL		Arid or semi-arid grassland with scattered mesquite

TABLE 6 SEASON OF USE AND ANIMALS FOUND IN THE UPPER SONORAN LIFE ZONE

Class of Animals	Common Name	Scientific Name	Season Of use	Classification 1/	Remarks
MAMMALS	Ord Kangaroo Rat	Dipodomys ordi	YL		Sandy soils preferred
	Plains Harvest Mouse	Reithrodontomys montanus	YL		Chiefly uplands
	Deer Mouse	Peromyscus maniculatus	YL		Most habitats
	Rock Mouse	peromyscus difficilis	YL		Rocky outcrops, cliffs, & canyon walls.
	White-throat Woodrat	Neotoma albigula	YL		Brushland & rocky cliffs with shallow caves
	Mexican Woodrat	Neotoma mexicana	YL		Rocks, cliffs, & mountains
	Porcupine	Erethizon dorsatum	YL		Usually forested areas
	Desert Cottontail	Sylviagus auduboni	YL		Pinon-juniper, open plains foothills
	Mule Deer	Ococoileus hemionus	YL	Game	Most habitats

1/ Rare, endangered, peripheral, status undetermined as classified by the Bureau of Sport Fisheries and Wildlife. Unique species are not common in New Mexico. Game and furbearers refers to animals so classified by New Mexico Department of Game and Fish.

TABLE 7 SEASON OF USE AND ANIMALS FOUND IN THE UPPER SONORAN LIFE ZONE

Class of Animals	Common Name	Scientific Name	Season Of use	Classification 1/	Remarks
BIRDS	Swainson's Hawk	Buteo swainsoni	M-S		Arid plains
	Golden Eagle	Aquila chrysaetos	YL		Open mountains, foothills, canyons
	Prairie Falcon	Falco mexicanus	YL	Status Undetermined	Canyons, open mountains
	Sparrow Hawk	Falco sparverius	YL		Open country, prairies
	Peregrine Falcon	Falco peregrinus	M-W	Endangered	Open country
	American Avocet	Recurvirostra americana	M-W		Alkaline lakes, ponds
	Mountain Plover	Eupoda montana	M-S	Status Undetermined	Semi-arid grasslands, plains & plateaus, near water
	Snowy Plover	Charadrius alexandrinus	M-S	Status Undetermined	Alkali Flats
	Killdeer	Charadrius vociferus	YL		Fields, irrigated lands
	Long-billed Curlew	Numenius americanus	M-S		High plains & range lands
	Upland Plover	Bartramia longicauda	M		Grassy prairies & fields
	Scaled Quail	Callipepla squamata	YL	Game	Grassland, arid country
	Gambel's Quail	Lophortyx gambelii	YL	Game	Thickets near water
	Band-tailed Pigeon	Columba fasciata	M	Game	Oak canyons, foothills
	Mourning Dove	Zenaidura macroura	YL	Game	Farm land,grassland
	Roadrunner	Geococcyx californianus			Open pinon-juniper, open country with scattered brush
	Screech Owl	Otus asio	YL		Wooded canyons
	Flammulated Owl	Otus flammeolus	S		Pine-oak woodlands
	Great Horned Owl	Bubo virginianus	YL		Cliffs, woodlands
	Pygmy Owl	Glaucidium gnoma	YL		Open coniferous or mixed woods
	Burrowing Owl	Speotyto cunicularia	YL	Status Undetermined	Open grasslands, prairies, deserts
	Long-eared Owl	Asio otus	YL		Junipers, mountain forests
	Saw Whet Owl	Aegoleus acadicus	M		Forests, conifers
	Spotted Owl	Strix occidentalis	M		Forests, conifers, wooded canyons
	Pied-billed Grebe	Podilymbus podiceps	YL		Fresh water ponds, streams
	Horned Grebe	Podiceps auritus	YL		Lakes, reservoirs, ponds

TABLE 7 SEASON OF USE AND ANIMALS FOUND IN THE UPPER SONORAN LIFE ZONE

Class of Animals	Common Name	Scientific Name	Season Of use	Classification 1/	Remarks
BIRDS	Mallard	Anas platyrhynchos	M-W	Game	Ponds, stock tanks
	Pintail	Anas acuta	M-W	Game	Ponds, stock tanks
	Mexican Duck	Anas diazi	YL	Rare	Same
	Gadwall	Anas strepera	M-W	Game	Stock tanks
	American Widgeon	Mareca americana	M-W	Game	Tanks
	Blue-winged Teal	Anas discors	M-W	Game	Dirt tanks
	Cinnamon Teal	Anas cyanoptera	M-W	Game	Dirt Tanks
	Green-winged Teal	Anas carolinensis	M-W	Game	Same
	Redhead	Aythya americana	M-W	Game	Same
	Canvasback	Aythya valisneria	M-W	Game	Same
	Ringneck Duck	Aythya collaris	M-W	Game	Same
	Lesser Scaup	Aythya affinis	M-W	Game	Dirt stock tanks
	Ruddy Duck	Oxyura jamiacensis	M-W	Game	Same
	Common Merganser	Mergus merganser	M-W	Game	Same
	Red-breasted Merganser	Mergus serrator	M-W	Game	Same
	Shoveler	Spatula clypeata	M-W	Game	Same
	Turkey Vulture	Cathartes aura	YL		All habitats, rare in winter
	Cooper's Hawk	Accipiter cooperi	W		Broken Woodlands, canyons
	Black Vulture	Coragyps atnatus	S		Very rarely seen
	Sharp-shinned Hawk	Accipiter striatus	M		Forests & thickets
	Marsh Hawk	Circus cyaneus	M-W		Fields & prairies
	Rough-legged Hawk	Buteo lagopus	M-W		Open plains
	Ferruginous Hawk	Buteo regalis	M-W	Status undetermined	Arid plains, open rangelands
	Red-tailed Hawk	Buteo jamaicensis	YL		Open country, mountain desert
	Water pipit	Anthus spinoletta	M		Plains, bare shores
	Bohemian Waxwing	Bombycilla garrula	M		Widespread
	Cedar Waxwing	Bombycilla cedrorum	W		Open woodland
	Loggerhead Shrike	Lanius ludovicianus	YL		Open country, low shrubs
	Starling	Sturnus vulgaris	YL		Open country
	Gray vireo	Vireo vicinior	M-S		Bushy mountains, slopes, mesas

TABLE 7 SEASON OF USE AND ANIMALS FOUND IN THE UPPER SONORAN LIFE ZONE

Class of Animals	Common Name	Scientific Name	Season Of use	Classification 1/	Remarks
BIRDS	Solitary Vireo	Vireo solitarius	S		Mixed forests, pine-oak woods
	Warbling Vireo	Vireo gilvus	M		Deciduous & mixed woods
	Virginia' Warbler	Vermivora virginae	M		Oak canyons, brushy slopes, pinons
	Black-throated green Warbler	Dendroica virens	M		Coniferous forests
	Blackpoll Warbler	Dendroica striata	Sp		Various trees in migration
	Hermit Warbler	Dendroica occidentalis	F		Conifer forests, in migration other trees
	House Sparrow	Passer domesticus	YL		Cities, towns & famrs
	Scott's Oriole	Icterus parisorum	S		Dry woods, scrub in desert, mountains
	Hepatic Tanager	Piranga flava	M		Open mountains forests, oaks, pines
	Black-headed Grosbeak	Pheucticus melanocephalus	S		Pine-oak woods
	Pine Grosbeak	Pinecola enucleator	M		Mixed woods
	Cassin's Finch	Carpodacus cassinii	M		Open forests
	House Finch	Carpodacus mexicanus	YL		Open woods, canyons
	Pine Siskin	Spinus pinus	M		Mixed woods
	Lawrence's Goldfinch	Spinus lawrencei	W		Open oaks, dry chaparral
	Red Crossbill	Loxia curvirostra	S		Pine-oak woodlands
	Scrub Jay	Aphelocoma coerulescens	YL		Foothills, oaks, brush
	Mexican Jay	A. ultramarina	YL		Open oak forests
	Pinon Jay	Gymnorhinus cyanocephalus	W		Pinon-pine, junipers
	Clark's Nutcracker	Nucifraga columbiana	W		High mountains
	Common Raven	Corvus corax	YL		Deserts, canyons
	White-necked Raven	Corvus cryptoleucus	YL		Arid country, plains & desert
	Mountain Chickadee	Parus gambeli	W		Winter visitor
	Plian Titmouse	Parus inornatus	YL		Pinon-juniper
	Bridles Titmouse	Parus wollweberi	S		Oak canyons
	Verdin	Auripus flaviceps	YL		Brushy desert valleys

TABLE 7 SEASON OF USE AND ANIMALS FOUND IN THE UPPER SONORAN LIFE ZONE

Class of Animals	Common Name	Scientific Name	Season Of use	Classification 1/	Remarks
BIRDS	Common Bushtit	Psaltriparus minimus	YL		Oak scrub, chapparal, pinon & juniper
	Black-eared Bushtit	Psaltriparus melanotis	YL		Oaks & junipers
	Red-breasted Nuthatch	Sitta canadensis	S		Conifer forests
	Pygmy Nuthatch	Sitta pygmaea	M		Pines
	Brown Creeper	Certhia familaris	W		Mature forest & groves
	Cactus Wren	Campylorhynchus brunneicapillum	YL		Cactus, yucca
	Canyon Wren	Catherpes Mexicanus	S		Cliffs, canyons, rockslides
	Mockingbird	Mimus polyglottos	S		Arroyos & hillsides
	Bendire's Thrasher	Toxostoma bendirei	S		Cholla, junipers
	Sage Thrasher	Oreoscoptes montanus	W		Brushy slopes, mesas
	Robin	Turdus migratorius	YL		Streamsides
	Western Bluebird	Sialia mexicana	YL		Scattered trees, deserts
	Townsend's Solitaire	Myadestes townsendi	W		Canyons, junipers
	Glue-gray Gnatcatcher	Polioptila caerulea	S		Chaparral, junipers
	Black-tailed Gnatcatcher	Polioptila melanura	YL		Desert brush
	Golden-crowned Kinglet	Regulus satrapa	M-W		Conifers
	Mountain Bluebird	Sialia currucoides	W		Open terrain with scattered trees
	Whip-Poor-Will	Caprimugus vociferus	M-S		Mountain slopes
	Poor-Will	Phalaenoptilus nuttallii	S		Stony hills, open pinon-juniper
	Common Nighthawk	Chordeiles minor	S		Treeless plains to mountains
	Lesser Nighthawk	Chordeiles acutipinnis	S		Arid open scrub, prairies
	White-throated Swift	Aeronautes saxatalis	W		Dry mountains & canyons
	Rufous Hummingbird	Selasphorus rufus	M-S		Flowering plants
	Red-shafted Flicker	Colaptes cafer	S		Canyons, semi-open country
	Yellow-bellied Sapsucker	Sphyrapicus varius	YL		Woodlands
	Harry Sapsucker	Dendrocopos villosus	YL		Mountain forests
	Downy Sapsucker	Dendrocopos pubescens	S		Broken or miexed forest woods

TABLE 7 SEASON OF USE AND ANIMALS FOUND IN THE UPPER SONORAN LIFE ZONE

Class of Animals	Common Name	Scientific Name	Season Of use	Classification 1/	Remarks
BIRDS	Ladder-backed Woodpecker	Dendrocopos scalaris	YL		Deserts, canyons
	Acorn Woodpecker	Melanerpes formicivorus	M		Pine-oak habitats
	Western Kingbird	Tyrannus verticalis	W		Open country with scattered trees
	Cassin's Kingbird	Tyrannus vociferans	M-W		Semi-open high country with scattered trees
	Ash-throated Flycatcher	Myiarchus cinerascens	M-S		Semi-arid country
	Olivaceous Flycatcher	Myiarchus tuberculifer	M-S		Oak slopes, pine-oak canyons
	Dusky Flycatcher	Empidonax oberholseri	M		Mountain chaparral
	Coues' Flycatcher	Contopus pertinax	M		Wooded canyons
	Olive-sided Flycatcher	Nuttalornis borealis	M		Conifer forests & burns
	Horned Lark	Eremophila alpestris	YL		Plains, desert prairies
	Violet-green Swallow	Tachycineta thlassina	M-S		Canyons, cliffs
	Cliff Swallow	Petrochelidon pyrrhonota	M-S		Open to semi-wooded country
	Purple Martin	Progne subis	M-S		Open forests
	Barn Swallow	Hirundo rustica	M-S		Cliffs, canyons
	Steller's Jay	Cyanocitta stelleri	W		Pine-oak forests
	Green-tailed Towhee	Chlorura chlorura	W		Dry, brushy mountain slopes
	Rufous-sided Towhee	Pipilo erythrathalamus	YL		Brush, chaparral, undergrowth
	Brown Towhee	Pipilo fuscus	YL		Brushy, stony areas
	Lark Bunting	Calamospiza melanocorys	W		Arid brush
	Savannah Sparrow	Passercula sandwichensis	W		Prairies, fields
	Grasshopper Sparrow	Ammondramus savannarun	M		Grassland,prairie
	Baird's Sparrow	Ammondramus bairdii	F		Long grass prairies
	Lark Sparrow	Chondestes grammacus	S		Open country with bushes & trees
	Vesper Sparrow	Pooecetes gramineus	W		Fields, sparse brush
	Rufous-crowned Sparrow	Aimophila ruficeps	S		Grassy or rocky slopes with sparse low bushes
	Cassin's Sparrow	Aimophila cassinii	W		Arid grassy country with bushes

TABLE 7 SEASON OF USE AND ANIMALS FOUND IN THE UPPER SONORAN LIFE ZONE

Class of Animals	Common Name	Scientific Name	Season Of use	Classification 1/	Remarks
BIRDS	Sage Sparrow	Amphispiza bellii	W		Dry brushy foothills
	Slate-colored Junco	Junco hyemalis	W		Mixed woods
	Oregon Junco	Junco oreganus	W		Mixed woods
	Gray-headed Junco	Junco caniceps	W		Mountain forests
	Chipping Sparrow	Spizella passerina	W		Open woodlands
	Clay-colored Sparrow	Spizella pallida	M		Open brush, brushy prairie
	Brewer's Sparrow	Spizella breweri	W		Brushy plains, weedy areas in winter
	Black-chinned Sparrow	Spizella atrogularis	YL		Brushy mountain slopes
	Harris sparrow	Zonotrichia querula	M		Pinon-juniper areas, brushy edges
	White-crowned Sparrow	Zonotrichia leucophrys	W		Scattered cover, low brush
	Golden-crowned Sparrow	Zonotrichia atricapilla	W		Desert shrubs in winter
	McCown's Longspur	Rhynchopanes mc'cowni	W		Plains & prairies
	Chestnut-collared Longspur	Calcarius ornatus	W		Plains & prairies
	Dickcissel	Spiza americana	M		Plains areas, shrubby grasslands & fields

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1/ Rare, endangered, peripheral, status undetermined as classified by the Bureau of Sport Fisheries and Wildlife. Unique species are not common in New Mexico. Game and furbearers refers to animals so classifed by New Mexico Department of Game and Fish

including insects and spiders, occur as either isolated or widely distributed populations depending upon the species.

The ranges of several endangered species overlap the study area. The Mexican duck (Anas diazi) occurs along the Rio Grande Valley and may at times frequent some of the stock tanks found within the study area. The southern bald eagle (Haliaeetus l. leucocephalus) roams great distances and may occur over the area, particularly during the winter. No definite sightings of this species have been noted. The American peregrine falcon (Falco peregrinus anatum), like the bald eagle, has a wide distribution. This species was sighted within the study area within the last two years by a BLM wildlife biologist. Oddly enough, the falcon was seen in the yucca grassland vegetative community near the Aden Lava Flow. Although this certainly is not a typical habitat for this species, the sighting is considered very reliable. Another falcon, the prairie falcon (Falco mexicanus) is found within the study area and is closely associated with yucca grassland communities.

Among the endangered mammals, the spotted bat (Euderma maculatum), and the Mexican wolf (Canis lupus baileyi) may occur within the study area. The occurrence of the latter species is highly questionable. However, because of the remoteness of the West Potrillo Mountains, this species may occasionally range into that area. The spotted bat may occur in the East Potrillo Mountains. This area does provide many crevices and other

retreats of sedimentary origin which may provide suitable habitat. No sightings or other data are available which confirm its occurrence here. Important habitat areas will be discussed further.

East Potrillo Mountains

These mountains consist primarily of limestone and support a large variety of plant species such as one-seeded juniper, Torrie's yucca and shrub live oak, uncommon to the other mountains within the proposed lease area. Therefore, these mountains provide a somewhat specialized habitat.

Mule deer are the only big game mammal found within the East Potrillo Mountains. Moore (18) reported a low population in this area; he estimates the population at one deer per section and speculated that vegetative cover is the important factor lacking in the overall habitat requirements of these deer. The low growing shrubs and grasses do not provide the cover that is associated with large deer populations. The rough terrain probably provides enough cover to support the small population. Due to the warm temperatures yearlong, very little seasonal movement is noticed.

Coyotes and bobcats are present in these mountains. The rough terrain provides cover for resting and producing young. The coyote will use some vegetation as a food source.

Scaled quail (Callipepla squamata) and mourning doves (Zenaidura macroura) are scattered throughout the East Potrillo

Mountains. The mourning doves use the area for nesting and migration while the scales quail are resident. Water may be the limiting factor for increasing their habitat.

Birds of prey utilize the East Potrillo Mountains but most of them are not restricted to this particular mountain range. The rough topography may supply certain habitat not found in other portions of the proposed lease area. The prairie falcon may use these mountains in the winter and may nest here due to the isolation and high protective recesses of crevices of these mountains. Other raptor may nest here for the same reasons.

West Potrillo Mountains

These mountains are composed of volcanic cones and craters and contain at least one plant species totally uncommon to the remainder of the study area. White sage (*Artemisia ludoviciodes*) was found to be quite common on the north facing slope and may be an important food source for the mule deer population as well as providing an important potential food source for pronghorn antelope (*Antilocapra americana*). Areas of lower elevation form large and small basins filled with a variety of grass and forbs.

Moore (18) reported mule deer densities within this area of approximately two deer per section. He believes that this herd is static at the present time.

Preliminary studies indicate that this area may provide suitable habitat for a small herd of pronghorn antelope. Although antelope are not found here at the present time, a

release has been recommended in the preliminary steps of the BLM Management Framework Plan. Final decisions regarding this recommendation are pending.

Coyotes and bobcats are known to inhabit this area. It is believed that both species use the area for hunting and denning but little is known about their population densities.

Scaled quail and mourning doves are found throughout these mountains in small numbers. The valleys in the area contain grasses, forbs, and cholla cactus (Fouqueiria splendens) which are known to supply some of the best scaled quail habitat in the study area. The mourning doves use the area for nesting and migrating.

Birds of prey occur within the area; however, the study team was surprised to find relatively low densities of these birds here as compared to the surrounding plains. Only a single pair of red-tailed hawks (Buteo jamaicensis) and several sparrow hawks (Falco spaiverius) were sighted in the West Potrillo Mountains, while a great variety of other raptor species were sighted on the nearby plains. The many volcanic cinder cones scattered throughout the West Potrillo Mountains may provide important nesting sites for raptors during spring and summer months.

Many other animals may inhabit the West Potrillo Mountains. However, an intensive wildlife inventory is needed to identify species and estimate populations.

Aden Lava Flow

This area consists of exposed lava, rough, uneven topography, and sinks vegetated with a wide variety of plant species. It represents the only habitat available for certain species in the study area.

The rock pocket mouse (Perognathus intermedius) is found within the Aden Lava Flow. A dark-furred ecotypic variation makes this species of interest to the mammalogist.

The blacktailed rattlesnake (Crotalus molossus molossus) has been collected in this lava flow (17). The isolation of this snake from its normal mountainous habitat is of special interest. Further study of its occurrence here and habitat requirements may provide valuable insight into the area's historical climatic conditions and former species distribution. It also occurs as a dark ecotypic form.

The study team also collected a horned lizard (Phrynosoma spp.) which appeared to be, likewise, a dark ecotypic form.

A gila monster (Heloderma suspectum) has been reported in Kilbourne Hole. This area is over 100 miles from the known range of this animal. The gila monster may have been released here or misidentified.

Mule deer, coyotes, and bobcats may inhabit the lava flow at certain times of the year. Cover and a variety of food sources attract these animals. Moore (18) reported the lava flow supplies natural dens used by the bobcat and coyote in raising their young.

Scaled quail inhabit the lava flow, while mourning doves use the area for nesting and during migration. Populations of these birds appear to depend upon the availability of water. The rough impervious lava formation make water available longer in this area than out on the plain.

No raptor species are associated directly with the lava flow. However, the study team observed a golden eagle over this area.

This area contains a large concentration of predator species which is an indication of high densities of prey species such as small mammals and rodents.

The Plain

The plain is somewhat undulating and is vegetated by communities of mesquite, creosote bush, and grassland. The mesquite type contains the highest animal population densities while the creosote bush and grassland types are somewhat less important.

The mule deer, coyote, and bobcat are occasionally seen within this area. The mule deer are casual users of the plain while the coyote and bobcat use the area for hunting.

The waterfowl habitat within the proposed geothermal lease area is limited due to the amount of available surface water and suitable adjacent vegetative cover. A large number of small stock tanks occur in this area but due to the low average annual precipitation many of these tanks do not contain water yearlong. These tanks are used by waterfowl in the spring and late fall

during migration and some species winter here. Moore (18) classifies the proposed lease area as low value waterfowl habitat.

Three species of upland game birds are found on the plain. They include: Gambel's quail (Lophortyx gambelii), scaled quail, and mourning doves. Although Gambel's quail are restricted somewhat to the plain, scaled quail, and mourning doves are found throughout the proposed lease area.

Gambel's quail are found usually along the rivers and in the rougher lands immediately above the flood plains. These areas contain mesquite and associated shrub and forb species used for cover and food.

Scaled quail are associated more with the flat open areas away from the rougher country. Creosote, ocotillo, and cholla (Opuntia sp.) are the main types of vegetation with some grass and forb species in the lower areas. Scaled quail are often associated with stock tanks.

Mourning doves are found throughout the proposed geothermal lease area, particularly in river thickets and in riparian vegetation near some stock tanks. The dove population increases in the fall due to migrations from the north.

Birds of prey are numerous throughout in the plains area. They include the rough-legged hawk (Buteo lagopus), Swainson's hawk (Buteo swainsoni), ferruginous hawk (Buteo regalis), zone-tailed hawk (Buteo albonotatus), marsh hawk (Circus cyaneus), sparrow hawk, red-tailed hawk, peregrine falcon, prairie falcon,

and the golden eagle (Aguila chrysaetos). The Aplomado Falcon (Falco femoralis) may also occur here, however, there have apparently been no authenticated sightings. The large concentrations in terms of both species and densities which occur here in winter months, would seem to indicate that this area is an important wintering area for birds of prey.

At least two species, the Swainson's hawk and the marsh hawk are common yearlong, remaining here in large numbers during the summer.

Many non-game birds inhabit the area. Some are resident while others migrate to or through the area during certain seasons of the year. A list of the birds that occur in the area are presented in Table 7.

Many other animal species occur in this area. Reptiles and amphibians and invertebrates are presented in Tables 8 and 9, respectively. Little information has been compiled by land managing agencies on these species due to the emphasis on the management of big game. More recently there has been increased interest by these agencies in these non-game species.

Ecological Interrelationships

The most complex plant and animal communities are found in the East and West Potrillo Mountains and in the Aden Lava Flow. These areas contain a very diverse and complex plant community which attracts a variety of animal species.

TABLE 8 SEASON OF USE AND ANIMALS FOUND IN THE UPPER SONORAN LIFE ZONE

Class of Animals	Common Name	Scientific Name	Season Of use	Classification 1/	Remarks
AMPHIBIANS AND REPTILES	Tiger Salamander	Ambystoma tigrinum	YL		In or near streams or ponds except when migrating.
	Canyon Treefrog	Hyla arenicolor	YL		Intermittent or permanent streams with rocky pools.
	Texas Banded Gecko	Coleonyx brevis	YL		Rocky areas with rock outcrops and canyons.
	Greater Earless Lizard	Holbrookia texana	YL		Sandy, gravelly soils.
	Collared Lizard	Crotaphytus collaris	YL		Rocky canyon areas, gullies, mountain slopes.
	Leopard Lizard	Crotaphytus wislizenii	YL		Arid & semi-arid plains.
	Crevice Spiny Lizard	Sceloporus poinsettii	YL		Rocky canyons, gullies, hillsides and rock outcrops.
	Tree Lizard	Urosaurus ornatus	YL		Pinon, mesquite, juniper
	Texas Horned Lizard	Phrynosoma cornutum	YL		Juniper, bunch grass
	Great Plains Skink	Eumeces obsoletus	YL		Grasslands & woodlands.
	Chihuahua Whiptail	Cnemidophorus exsanguis	YL		Rocky hillsides & canyons
	Western Blind Snake	Leptotyphlops humilis	YL		Desert to brush covered mountains and rocky hillsides.
	Ringneck Snake	Diadophis punctatus	YL		Moist habitats in woodlands, chaparral and forest grassland.
	Mountain Patch-nosed Snake	Salvadora grahamii	YL		Rocky canyons and mountain slopes.
	Corn Snake	Elaphe guttata	YL		Rocky hillsides
	Gopher Snake	Pituophis melanoleucus	YL		Woodland brushland

TABLE 8 SEASON OF USE AND ANIMALS FOUND IN THE UPPER SONORAN LIFE ZONE

Class of Animals	Common Name	Scientific Name	Season Of use	Classification 1/	Remarks
AMPHIBIANS AND REPTILES	Texas Lyre Snake	Trimorphodon vilkinsoni	YL		Mountains
	Western Diamondback Rattlesnake	Crotalys atrox	YL		Rocky canyons & lower mountains.

1/ Rare, endangered, peripheral, status undetermined as classified by the Bureau of Sport Fisheries and Wildlife. Unique species are not common in New Mexico. Game and furbearers refers to animals so classified by New Mexico Department of Game and Fish.

TABLE 9 SEASON OF USE AND ANIMALS FOUND IN THE UPPER SONORAN LIFE ZONE

Class of Animals	Common Name	Scientific Name	Season Of use	Classification 1/	Remarks
INVERTEBRATES	Juniper Cerambycid Beetle	Tetraopes femoratus	S		Pinon-juniper areas.
	Metallic Leaf Beetle	Chrysochus auratus	S		All places where the plant apocynum occurs.
	Ladybird Beetle	Hippodamia convergens	S		All habitats.
	Broomweed Longhorn Beetle	Crossidius pulchrus	S	Unique	Dense broomweed patches.
	Monarch Butterfly	Danaeus plexippus	Sp-S		Milkweed areas.
	Mourningcloak Butterfly	Hymphalis antiopa	Sp-S		Broadleaf tree areas.
	Swallowtail	Papilio turnus	Sp-S		Moist situations.
	Tent Caterpillar	Malacosoma americana	Sp-S		All areas.
	Painted Lady	Vanessa cardui	Sp-S		Open, brightly colored habitats.
	Damsel Fly	Lestes sp.	S		Shallow pools with aquatic vegetation.
	Dragon Fly	Libellula sp.	S		Ponds with aquatic vegetation
	Mosquito	Culex pipiens	S		Near water.
	Horse or Deer Flies	Silvius sp.	S		All habitats.
	House Fly	Musca domestica	Sp-S-F		All habitats.
	Migratory Grasshopper	Melanoplus biliteratus	S		Semi-arid to sub-humid areas.
	Field Cricket	Acheta assimilis	S		All habitats.
	Pinon Grasshopper	Trimeropteris cyanea	S		Pinon-juniper areas.
	Mesa Grasshopper	Trimeropteris vinculata	S		Short grass prairies.
	Yellow Jacket	Polistes sp.	Sp-S-F		All Habitats.
	Honey Bee	Apis	Sp-S-F		All Habitats.
	Harvester Ant	Bombus sp.	Sp-S-F		Wet meadow type habitats.
	Digger Wasps	Bombex sp.	Sp-S-F		Sandy areas.
	Water Strider	Gerris sp.	Sp-S-F		Most semi-permanent & permanent water areas.

TABLE 9 SEASON OF USE AND ANIMALS FOUND IN THE UPPER SONORAN LIFE ZONE

Class of Animals	Common Name	Scientific Name	Season Of use	Classification	Remarks
INVERTI-BRATES	Backswimmer	Notonecta undulata	Sp-S-F		Most permanent water areas.
	Water Boatman	Arctocorixa interrupta	Sp-S-F		Pinon-juniper and yucca areas.
	Pentatomid Bug	Peribalus limbolarius	Sp-S-F		Pinon-nuniper and yucca areas.
	Giant Water Bug	Abedus sp.	S		Permanent water with slow or no current.
		Gammarus lacustris	YL		Fresh water areas.
	Wood Tick	Dermacentor sp.	YL		Higher wooded or brushy habitats.
	Tarantula Spider	Aphonopelma sp.	YL	Unique	Open hillside areas & mixed desert growth.
	Black Widow Spider	Latrodectus mactans	YL		Dark, damp areas.
	Whiptail Scorpion	Thelyphorus sp.	Sp-S-F		Short grass prairies to pinon-juniper
		Holospir cockerelli	YL		Dry lower slopes.
		Oreohelix metcalfei concentrica	YL		Limestone outcrops above 7,500 feet elevation.
		Oreohelix metcalfei radiata	YL		Limestone outcrops.
		Oreohelix metcalfei acutidiscis	YL		Limestone outcrops.

1/ Rare, endangered, peripheral, status undetermined as classified by the Bureau of Sport Fisheries and Wildlife. Unique species are not common in New Mexico. Game and furbearers refers to animals so classified by New Mexico Department of Game and Fish.

Water is the most important limiting factor in the desert. The East and West Potrillo Mountains receive greater amounts of rainfall due to their uplifted topography. Cooler temperatures and reduced evaporation rates also serve to conserve water. Many of these mountain soils are rocky and are close to bedrock. Water percolates into these shallow to moderately deep soils and often reaches an impervious layer where it begins to move laterally. This water is concentrated and may eventually reach the soil surface somewhere down slope. Depressions under rocks provide storage areas for water. This water is lost through transporation and evaporates but the rock covering greatly aids in slowing the evaporation process. Slope aspect also influences the moisture availability. The north and east facing slopes are cooler, thus more mesic than the hot south and west facing slopes. A wide variety of plant species cover the mountains with variations in composition and density due to slope aspect.

The Aden Lava Flow is almost level with a very diversified microrelief. When the lava flowed over the surface many air pockets were formed. Many of these pockets are close to the surface and may hold water for vegetative production. When precipitation falls, it runs into these depressions where it is collected. The water might further percolate through the soil into one of these shallow air pockets to be stored. The rough microrelief also protects the vegetation from winds, thus reducing evapotranspiration. The combination of these factors

produces many variations in microclimate often affording habitat for more specialized plant and animal forms.

The complexity of the plant and animal communities decreases as topography changes from the desert mountains, across the piedmonts, and onto the desert plain. The mesquite, creosote, and grassland types are found on the plain and were described in detail under the section on vegetation. These communities are not as complex as the desert mountain and lava flow communities. In fact, some are almost monotypic.

The Aden Lava Flow possesses a specialized isolated ecosystem which is unique to the study area. Some species found in this area are usually associated with desert mountain communities, i.e., mule deer, black-tailed rattlesnakes. The habitat requirements of these wildlife species are somehow being met in the Aden Lava Flow. Whether these wildlife populations are decreasing, static, or increasing is not known. The roughness of the area and the vegetation present may produce habitat for species not yet identified.

The West Potrillo Mountains support an excellent stand of grasses. This species composition appears to represent a community near climax. However, further studies are needed to justify this hypothesis.

The East Potrillo Mountains are composed of limestone, thus the area contains another unique habitat found in the area. A completely different array of flora and fauna is or may be

present here. The presence of one-seed juniper on the north slopes is interesting. Many of the old trees are dead. This species alone probably serves as an indicator of past climatic conditions and points to the fact that the entire area has become drier during recent decades.

Ecological studies are needed in the Aden Lava Flow, the East Potrillo Mountains and the West Potrillo Mountains. These studies should provide information on the ecological interrelationships expressed in each of these isolated areas, thus providing data necessary in the continuing study of ecological phenomenon in the arid deserts of the southwest.

The mesquite type, in association with grasses and yucca, contains a very active animal community. The sand dunes around the mesquite supply cover for above ground animals while the loose sands supply a substrata for the burrowing species. Birds of prey and predator animals frequent these areas in abundance due to the availability of prey species.

The least diversified plant community is undoubtedly creosote. Of ecological interest is the ability of creosote and animals found in this association to withstand the climatic stresses placed upon it.

Other environmental factors are:

1. The survival of the desert and semi-desert communities as with all other communities, depends largely upon the maintenance of the microclimate.

2. Secondary succession is very slow within a desert community due to limited water availability and high soil temperatures.

3. Regression of perennial vegetation to annuals may occur with soil disturbances and vegetative removal.

4. Bird species become adapted to man-made structures. Birds of prey may use tall structures as observation perches and nest sites. Song birds may use other facilities for nesting and resting.

5. There are many specialized forms of plant and animal species occurring in the desert. Alterations, destruction, or a decrease in size of habitat may result in long term or permanent removal from the community.

Human Interest Values

Landscape character

Open space

The landscape can be described as being a desert type with varieties of vegetation common to the semiarid and arid portions of southwestern New Mexico. Vertical variations in the landscape amount to less than 100 feet except for the mountains and cinder cones that, in general, cover the western portion of the proposed geothermal lease area.

Visibility from any viewing point ranges up to fifty miles. Man-made intrusions are minimal for an area of this size. They include back country roads; a single track railroad which runs

southeast to northwest across the area; telephone and electric transmission lines that parallel the railroad; an underground natural gas line and a pumping station north of and parallel to the railroad, and electric and telephone service lines to ranch headquarters. An abandoned railroad bed parallels the Mexican border on the south boundary of the area.

Open space characteristics are dominant when evaluated on a ratio of natural or man-made intrusions versus the total area (12).

Scenic quality

Key factors established for evaluation of scenic quality are land form, color, water, vegetation, uniqueness, and intrusions (11). A numerical value and alphabetical class evaluation score results from using given criteria and making comparisons to regional land areas. The Kilbourne Hole proposed lease area scenic value has been given a middle B rating on a scale of C = 1-9, B = 10-14, and A = 15-24. This means that when this area is compared with regional scenic values, using the criteria, the scenery is rated as average.

There are three geological features in the potential lease area that deserve special attention; they are the West Potrillo Mountains, Kilbourne Hole, and Hunt's Hole.

The West Potrillo Mountains are different from the rest of the area because they are volcanic formations. Several distinct craters are visible. The physical structure of these mountains is uncommon in this region, mainly because the formations are extensive.

Vegetation in this mountain area is desert grassland which appears near climax condition (almost uneffected by grazing). The mountains are arid, without water except during and after rain showers. A few man-made reservoirs provide water for livestock.

The mountains are remote. They have not attracted people in the same way most other mountainous areas in the region have. Only a few primitive ranch roads go into them and none go completely through. Livestock grazing is made possible by providing watering sources.

The West Potrillo Mountains have attracted the attention of wilderness enthusiasts because of the primitive situation that exists there.

Kilbourne Hole and Hunt's Hole were rated in the BLM Recreation Information System as part of the overall scenic value. They are large structural depressions that stand out because they contrast with the surrounding desert geology (see section on geology). The location of these 'holes' makes them accessable to numerous visitors. Hunters, motorcyclist, 4-wheel drive enthusiasts, and persons driving and sightseeing for the pleasure frequent these sites.

Primitive values

Primitive values relating to the Kilbourne Hole proposed geothermal lease area are set forth in the Bureau of Land Management planning system documents for the Las Uvas planning unit. Criteria used in evaluating the area include the following factors: (1) Intrusions, (2) Scenic quality, (3) Wildlife, (4) Fisheries, (5) Water usability, (6) Size, and (7) Uniqueness. By rating the area according to these factors and applying numerical values

to quality of the factor a primitive value score of 'B' was established. Class scores are A = 20 points or more, B = 15 - 20, C = 8 - 14 (10). The criteria used take into consideration qualities which are considered pertinent to primitive values. The rating of 'B' expresses an average value when compared to other similar type areas in the region.

Land uses

Grazing

The predominant use of national resource and other lands in the study area is for the grazing of cattle. Grazing values are generally poor ranging from 2 to 8 CYL (cows yearlong) per section. Many parts are not grazed because of rough terrain, the lack of stockwater, and low grazing values.

Rights-of-way

There are numerous pipelines, transmission and distribution powerlines, communication lines and micro wave sites, county roads, and highways in the area. The major rights-of-way form a corridor containing the interstate pipelines, the telephone lines, and the Southern Pacific railroad. An old railroad line along the Mexican border was abandoned and the northerly 150 feet of the 200 feet right-of-way was deeded to the New Mexico Highway Department in the early 1960's. The remaining 50 feet of the right-of-way was retained by the railroad.

A route for two new 345 KV lines has been examined. It would be adjacent to the existing interstate pipeline and railroad rights-of-way. The companies concerned have not made a final decision to construct at this time. Original plans called for construction of the

first line in 1977.

Recreation

Off-road vehicle (ORV) use, small game hunting, and weekend outings comprise the majority of the land used for recreation. The county fair is held on a tract of land on the north edge of the area. The City of Las Cruces plans to acquire 530 acres from the BLM for park development on the west mesa overlooking the valley and adjacent to Interstate 10. Recreation use is light except in a few areas along the Rio Grande Valley and near the heavily populated El Paso area.

Mining

There has never been any significant mineral production except for sand, gravel, and cinders. The mineral extraction areas consist of several sand and gravel sites used by the state and county highway departments. There are several volcanic cinder extraction sites located on several volcanic cinder cones. Two community sand and gravel pits are adjacent to the Rio Grande Valley.

Agriculture

There is no crop production in the area. The principal limiting factor is the lack of irrigation water. The extreme western part of the study area is in the Mimbres Valley declared (State engineer declaration) underground water basin. The water table has been declining in this basin for some time and no new permits to irrigate new lands are available. Five desert land entries have been patented in the "open" water basin in the Hunt's Hole area, however, the water table in this area declined and the cultivation of crops was abandoned.

Urban and suburban

The east edge of the area parallels the heavily populated urban-

suburban farming area of the Mesilla Valley and an expansion from the valley has begun at locations in the vicinity west of Las Cruces and in the area north of Anapra. Studies and research are being conducted by New Mexico State University and the Southern Rio Grande Council of Governments to determine the economic effects on the surrounding area of the proposed development of an international port of entry at Anapra. When it is developed it will have a significant impact on the Federal lands in that area. The City of Las Cruces five mile planning and platting jurisdiction encompasses about 10 sections of national resource land in the proposed lease area. The city limits of El Paso, Texas are within two miles of the national resource land in the Anapra area.

Archaeological values

Important archaeological sites have been found in a few locations in the proposed leasing area. The Bureau of Land Management let a contract to New Mexico State University for an archaeological survey of the area. This survey found fifteen unrecorded prehistoric sites in the proposed geothermal leasing area. Attempts were made to check as many areas as possible in order to obtain habitation patterns. No attempt was made to make an intensive survey. Most evidence was scattered and consisted of occasional stone tools and flakes and scattered potsherds.

High density areas are overlooking the Rio Grande River Valley and around Playa Lakes and sand dunes. Particularly heavy densities were found south and southwest of the East Potrillo Mountains, around the edges of Playa Lakes and natural tanks and the perimeter of Hunt's

and Kilbourne Holes. Areas of low density were in lava flows, and concentrations of basalt cobbles such as at the base of the East Potrillo Mountains and the West Potrillo Mountains, the bottom of Kilbourne Hole, Hunt's Hole and Phillips Hole were low density areas. The report describes the Physiography of the Area, the Prehistory of the Area and the location and description of the newly recorded sites. The maps contained in the report show locations of all known archaeological sites and greatest potential for the occurrence of other sites (Appendix D).

Other scientific values

Other scientific values are of educational, geologic, botanical, and zooligical nature about which we lack complete knowledge.

Areas in the Aden crater lave flow (The Malpais) have been reported to contain unusual, interesting, and sometimes rare zoological specimens. The Malpais, Hunt's and Kilbourne Hole, the various craters, and the East and West Potrillos are of interest as natural areas.

Other Considerations

Population centers, planning and zoning

Population centers in the Rio Grande Valley parallel the east side of the proposed lease area. The greatest concentration of people approximately 1,000,000, are in the Las Cruces, El Paso, and Juarez, Mexico areas. Only a few residents live in the proposed lease area.

Several public hearings were held in July and August 1970, by the Dona Ana County Planning and Zoning Commission regarding adoption of a comprehensive plan for those portions of the county subject to

urbanization. The plan was developed by Harland Bartholomew and Associates and modified by the commission. In this plan the urbanizing portions of the county were considered to include the Mesilla Valley and associated Rio Grande Valley south from Las Cruces to the Dona Ana County - New Mexico - Texas state line. A conservation (conforming use) type zoning was proposed for the remainder of the county (9).

Due to the great number of unfavorable comments and protests to the proposed plan, the County Commissioners rejected it and requested the County Planning & Zoning Commission to formulate new zoning proposals for the entire county. A plan is now being developed by Yguardo & Associates of Albuquerque. To date, no action has been taken on the plan by the county until a review can be made of the subdivision law enacted by the 1973 New Mexico State Legislature.

Municipalities in New Mexico govern subdivisions within their corporate limits plus three, five, or ten miles of planning and platting jurisdiction depending on their size. In the area lying outside of the municipality's corporate limit but within its planning and platting jurisdiction, the county and muncipality have concurrent jurisdiction. (See State of New Mexico Laws on subdivisions 14-18-1 to 12, 14-19-1 to 14.1, and 70-3-1-9 NMSA). Corporate communities of 100,000 persons or more have a planning and platting jurisdiction of 10 miles, 25,000 to 100,000 persons 5 miles, and less than 25,000 persons 3 miles, provided their territory is not within the boundary of another municipality. National resource lands in the lease area close to Las Cruces and El Paso are affected by this jurisdiction for planning and platting.

A comprehensive plan for Las Cruces was adopted by their Planning and Zoning Commission on April 15, 1969. This plan was developed by Harland Bartholomew and in cooperation with the Department of Housing and Urban Development under the urban planning program. The plan relates to the City of Las Cruces and the immediate areas adjacent to the city limits. The city planning commission received a grant in 1973 to update the plan to begin a land use study in the extraterritorial planning and platting area. The Southern Rio Grande Council of Governments which is the regional planning agency for Dona Ana, Sierra, and Socorro Counties sponsored the grant.

In the area of joint concern a special six member commission will be appointed, three from the City of Las Cruces and three from Dona Ana County. Until this commission is formed and a land use study is completed, only general recommendations can be expected from the local authorities on national resource lands in the extraterritorial planning and platting area.

Luna County is one of four counties in the Southwest New Mexico Council of Governments planning area. A comprehensive plan for development for the county was approved on July 24, 1973. This planning document meets the requirements set out in Section 701 of the Housing Act of 1954, as amended and administered by Housing and Urban Development Administration. This plan is the first of a series and can be used only as a guide to policy and administrative decisions. It outlines a broad series of recommendations to be followed in the initial planning stages.

State Statues (NMSA 15-36-26 and 15-36-35) gives the county

authority to adopt a county zoning ordinance but it has not been exercised by Luna County. Since the county is without an ordinance it is without a means of land use control. This is evident by the 88,000 platted lots in the county which theoretically have potential for occupancy by 350,000 people.

ANALYSIS OF PROPOSED ACTION AND ALTERNATIVES

Environmental Impacts of Proposed Action

Anticipated Impacts

Leasing

Obviously, geothermal leasing itself does not produce impacts upon the environment. However, after the lease is issued impacts will occur during post-lease exploration and increase through the several phases of development and production. Anticipated impacts will be analyzed under exploration pre and post lease, development, production, and close out in the following sections.

Non-living Components

Climate

Climate will not be seriously impacted by geothermal development. However, climate greatly influences impacts upon soils, vegetation and other related environmental components. These relationships will be discussed in the appropriate sections.

Topography

Topography will only be impacted to the extent that the area is cleared, leveled, or otherwise altered to accommodate geothermal development. The area is usually flat and very little leveling is necessary to construct drill pads, pipelines, power plant site, possible villages, transmission lines and roads. Topography, like climate, is an important factor to consider because of its influence on its associated environmental components. These relationships will be discussed under the appropriate sections.

Soils

The important soils associations within the proposed lease are:

Pintura-Berino-Simona

Cacique-Pintura

Rockland-Akela-Graham

These three associations comprise about 75 percent of the soils within the area. They are classified as fine sands and gravelly loams (16). Characteristics important in determining the impacts upon the soils are: erodibility, compactibility, and permeability. The impacts upon soils during the different phase of geothermal developments are discussed below.

Exploration (Pre-lease)

Small mobile rigs and vehicles will traverse the country and in the process will compact the soils. Existing roads will be followed as much as possible but off road use will definitely result. Each time a new set of vehicle tracks leave an existing road it gives other drivers an incentive to do the same. Many of these tracks may become permanent roads while others may become gullies. The loose sandy soils should not be compacted to any great extent by the lighter vehicles even when the same trails are used more than once, but as these roads are made, vegetation is also disturbed or destroyed. This in turn exposes soils to both wind and water erosion.

Small areas may be cleared of vegetation for setting up small drill rigs. In the process, soils will be exposed to wind and water erosion. While these rigs are in place soil compaction will take place due to the intense activities around the rig. Permeability is decreased,

thus concentrating any run off. Small mud pits may be required to store the effluent. If the pits are not prepared properly pollution of the soil profile may result due to the rapid permeability of the soil. Also, oil spills from vehicles and rigs may add to soil pollution.

Exploration (post-lease)

After the lease is issued large drill rigs will be required for the drilling of deep exploration holes. Heavy equipment will traverse the land. If enough activity occurs a road will become established. Tracks on level areas will not channel water as much as on steeper areas. Vegetation will be removed either by grading or intensive use. Usually the service roads become permanent through continued use.

Large drill pads will be cleared of vegetation. This usually requires an area of about 300' x 300' or about 2 acres. This disturbance will expose a fairly large surface to wind and water erosion but with extensive activity the soils will become compacted, thus reducing soil losses. If mud is used during the drilling operation, large retention pits will be needed. Oil spills from the drilling rig and from service vehicles may also contribute locally to soil pollution.

Development

If exploration indicates that the geothermal resource is sufficient to produce electricity economically, many deep wells will likely be drilled. This will increase the human activities on the area immensely. Each drill pad will impact the soil as described in the exploration phase. Soil disturbances will increase by at least 2-3 acres each time a well is located. If wells are on 40 acre spacings, 16 wells

x 2 or 3 acres will result in 32 to 48 acres disturbed for each 640 acres. If wells are on 20 acre spacings, 32 wells x 2 or 3 acres will result in 64 to 96 acres disturbed for each 640 acres. This does not include soil disturbances from pipelines, powerlines, power plant sites and roads used for access and maintenance.

Pipelines on the surface are required to transport steam or hot water to the power plant. A small diameter pipeline usually starts from the most distant point and increases in diameter as other wells are connected enroute to the power plant. The soil is impacted due to the construction of the pipeline. There,rights-of-way may be cleared of vegetation and a maintenance road established. Vehicles are used in clearing the right-of-way and in the construction of pipelines. Soils will be exposed to wind and water erosion. The maintenance roads will become compacted with use, possibly preventing some soil losses although these roads still concentrate runoff. In level topography some erosion occurs but as slope increases so does erosion. Fluids may be spilled on the soil resulting in small isolated areas of pollution.

Power plants may be constructed depending upon the availability of geothermal energy produced by each well. Each power plant covers an area of about 5 acres. These areas are completely cleared and leveled where necessary. This exposes additional soils to erosion and compaction. Depending upon the well spacing and energy resource, one or two power plants may be constructed on each section. This will further increase the surface disturbance by 5 to 10 acres for each 640 acres.

Transmission lines are required to transport the final product -

electricity to the consumer. This electricity may supply consumers in El Paso, Texas; large and small cities in New Mexico and possibly cities in Arizona. Therefore, a number of large powerlines may be constructed to connect with other lines that supply electricity to these areas.

Powerlines constructed within the proposed area will disturb soils during construction. Large, heavy vehicles are required to transport and construct these powerlines. Soil erosion and compaction will result from these activities. A maintenance road is usually required along these large powerlines. Therefore, another road is introduced into the area that may add to erosion problems. Some existing roads may be used.

A field office may be established somewhere within the proposed field. Due to the distance from Las Cruces or other towns a small village may develop around the field office to supply services to the field employees. Trailer courts, grocery stores, gas stations, and bars may develop. This will impose surface impacts on many acres of land. An area will be cleared and leveled. The soils would be compacted in order to construct buildings and roads throughout the village. Erosion would take place when an area of this size is exposed to wind and water. Many problems will result from soil pollution. Human waste must be disposed of. Sanitary land fills may be built to dispose of the solid waste. All of these activities would have various impacts upon the soil.

Roads will produce the greatest impact to soils due to the number of surface acres they will occupy. Roads are required for access to

drill pads, well heads, pipelines, transmission lines and power plants. This will form an extensive interconnected network of roads. Many of these roads will present erosion problems. These roads will permit access into all portions of the area, thus other soil damages may occur as a result of this new access.

Production

Drill rigs, pipelines, powerlines, power plants, a possible camp or village, and roads will continue to be developed until the geothermal reservoir is completely developed. These developments should have the same impacts upon the soils as discussed in the development phase. However, it is possible that these activities may intensify if a large geothermal resource is discovered.

Close-out

If the field is ever abandoned, removal of surface installations will result. This will again disturb soils which may have stabilized in the 30 years or more that the geothermal field had been in production. Some rehabilitation will take place as individual wells and other facilities are abandoned. In other instances some rehabilitated areas may again be disturbed. By the time of abandonment, rehabilitation may be advanced to the stage where these southwestern deserts can be reseeded with favorable and predictable responses.

Air

Some pollutants may be released into the air during certain phases of the operation. Also, the type or types of systems present when and if a geothermal field is discovered will make differences in the amount and

in this area but dust will usually settle each day and most of the hydrocarbons will be lost within the mixing of the atmosphere.

Long term pollution may come from the wells themselves. In dry steam systems, steam and non-condensable gases are released into the atmosphere. Each well must be bled off. Methods of this bleeding vary from company to company resulting in very small to moderate amounts of steam and non-condensable gases released into the atmosphere.

Hydrogen sulfide is the dominant non-condensable gas releasing into the atmosphere at the Geysers. Approximately 100 wells are released about 90 tons of hydrogen sulfide into the atmosphere daily. This and other gases may cause long term air pollution but methods are being tested at the present time in the Geysers to prevent these gases, especially hydrogen sulfide, from escaping into the atmosphere.

Hot water systems will be piped on the surface to confine the water. Bleed off is not generally needed in these wells. However, pressures may be reduced as the water is brought from the well to the surface. This process produces a certain amount of steam that is separated. The steam is transported

types of pollutants released into the atmosphere.

Exploration

Pollutants will be released into the atmosphere normally in small quantities. Dust will rise from the roads as they are traveled by vehicles. Some hydrocarbons from the drilling operations and service vehicles will be released. However, a large amount of pollution is not foreseen unless something is discovered in these drill holes that is not expected at this time.

Development

If exploration leads to development, air pollution from vehicles, drill rigs, and the geothermal system itself will increase. When pipelines and maintenance roads are constructed still further dust and hydrocarbons will be released into the atmosphere. Power plants may be constructed, and equipment here again will release more particulate matter and hydrocarbons into the atmosphere. The construction of powerlines will add to air pollution. All of these activities are localized. They are short term activities lasting from about 3 months on wells to 2 years for the construction of a power plant. Many wells, pipelines, power plants, and transmission lines may be built

along with some non-condensable gases to the power plant. Here some of these gases are released into the atmosphere as electricity is produced. Some soluble minerals are present in the hot water and, as the water is flashed to steam, these minerals become more concentrated in the smaller volume of water. This water may be reinjected into the reservoir or released on the surface into evaporation ponds.

A heat exchanger system may be used in conjunction with the hot water system. With this system, the hot water is brought to the surface, piped to the heat exchanger, and then reinjected into the reservoir. Thus, minimal air pollution will result.

Dry rock systems are still in the experimental stages. No data is available regarding their development and effect on air pollutants at this time. By the time this field is developed, technology may have greatly eliminated air pollution. If not, winds may carry non-condensable gases such as hydrogen sulfide into already polluted areas. Spring winds blowing from the west may carry gases into the Rio Grande Valley and El Paso. During the winter, air movements may move pollutants into Mexico. Pollutants may mix over the geothermal field in the summer

and fall due to southeasterly winds carrying pollutants from El Paso. Average yearly winds may not be strong enough to carry pollutants far enough before they are dissipated within the mixing atmosphere, therefore causing no long term area pollution.

Production

If electricity is produced in this area, air pollution will continue to increase. During production the dry steam system will continue to release steam and non-condensable gases into the atmosphere from wells and now from power plants. This increase in non-condensable gases may have lasting effects. Vegetation and animals may be affected by this increase in air pollution. The increase in pollution may now affect the urban population of the Rio Grande Valley and El Paso.

Hot water systems may also increase air pollution. If the hot water is flashed to steam a certain amount of non-condensable gas can be produced depending upon the mineral composition of the hot water. If a heat exchanger and reinjection system are used, air pollution should not result except in accidental cases.

Dust from existing and new facilities will increase the particulate matter in the air. Dust will be a problem until the close out phase except for paved roads and padded surfaces used for facilities, etc. due to the type of soils within this area. New drill pads, pipelines, power plants and transmission lines will be constructed in order to completely develop the geothermal resource. These facilities and the number of vehicles present will add to the dust problem.

Hydrocarbon emission will also increase with further development.

A large number of motorized vehicles will be used in operations of a geothermal field.

Close out

Air pollution should decrease drastically in this phase. When all activities cease, no more hydrocarbons from vehicles and non-condensable gases will be released into the atmosphere. Dust will remain a problem unless all disturbed areas are successfully revegetated.

Geology

It is expected that relatively few geologic hazards will be associated with geothermal exploration and subsequent development within the Kilbourne Hole area of New Mexico. Very little baseline data exists for this and most other areas of New Mexico and no pertinent studies are known to be currently in progress.

Seismicity is the only geologic hazard on which useful data has been collected and published. Historical records indicate that the most seismically active part of the state is the Rio Grande rift zone. The most active segment within this zone extends southward from Albuquerque through Socorro in the west-central portion of the state, well outside the subject area of this EAR.

The overall seismicity of even the most active regions of the state is actually very low when compared to most other areas which are seismically active. A magnitude 5.5 earthquake which occurred near Dulce in 1966 was the strongest shock in New Mexico since 1938 when a tremor of equal magnitude occurred in the Mogollan Mountains. According to Sanford (22, 23, 24 and 26) the largest shock in a 100-

year period, based on historical data, is likely to be a magnitude 6.0. Based on both instrumental and historical data, the areas of greatest seismic activity in descending order of activity, are: 1) Socorro-Bernadro,2) Albuquerque-Belen, and 3) El Paso-Las Cruces. When considered in terms of the overall seismicity in the western U. S., the true risk to geothermal development represented by this activity is not great.

The effect of geothermal development on seismic activity, on the other hand, is not well understood. If fluid pressures in geothermal fields are to be substantially altered by exploitation and reinjection, the possibility of modifying the mode of seismic energy release does exist. At this point, however, there is insufficient data to predict seismic behavior of potential geothermal systems in the subject area during production or reinjection of fluids. Development of a geothermal field may, in some cases, increase and in other cases decrease the occurrence of events (31). In most instances, however, the influence of these activities on seismicity will be negligible.

The degree of hazard represented by subsidence, as a result of fluid withdrawal, is also unpredictable at this point. Groundwater records do not exist for the Kilbourne Hole region. In the event that subsidence does occur, however, no adverse effects are anticipated as the area is sparsely populated and the land surface is not presently heavily utilized (i.e., irrigation systems, etc).

Although renewed volcanism is a possibility which cannot be entirely dismissed, the likelihood of renewed volcanic activity within

the expected lifespan of any geothermal development is sufficiently remote as to be ruled out as a probable geologic hazard.

Based on reports from the field, the potential risk from landslides is considered to be quite low. There are areas of considerable relief, but the geology is generally favorable for stable slopes. Generally, without an unusual and unpredictable triggering mechanism, such as a violent earthquake, landslides and other slope failures should be considered unlikely.

The mountains and areas of rugged terrain within New Mexico combine with the arid climate to provide an environment favorable for flashfloods. No studies have been conducted, to the best of our knowledge, which clearly delineate the degree of hazard represented by flashfloods in New Mexico. However, flashfloods, when they do occur, are capable of uprooting trees, equipment, and vehicles, and damaging pipelines and various structures.

Since flashfloods tend to follow established drainage channels, those channels and dry washes which reveal a history of sudden floods of great volume and short duration can be expected to experience such floods again. When such dry washes are identified, special precautions should be taken to protect in or near the drainage, or the drainage should be avoided altogether.

Water

Exploration

Due to the fact that there is no surface water in the lease area except in stock tanks developed primarily by ranchers, no significant

impact would be anticipated on the surface water.

Under a "Notice of Intent", shallow thermal test holes may be drilled by using mud; therefore, water would probably be taken from nearby wells for that purpose. The amount of water needed would depend on the intensity of the exploration. The draw-down on the water table for such purposes would be expected to be negligible. In most cases exploration holes, either thermal gradient or heat flow, would probably be shallow enough not to intersect the water table.

Deep holes drilled to discover geothermal resource, however, would penetrate the fresh water zones which are located at relatively shallow depths. Whether these holes would be drilled with air or mud would depend on conditions in the subsurface. If mud was used, a source of water would be necessary. The quantity of water necessary for drilling purposes would depend on several factors, including the depth of the hole, the size of it, and the porosity and permeability of the subsurface strata.

If a geothermal resource was discovered and allowed to flow to the surface, the hot water may contain dissolved solids which would precipitate out on the test area or into reserve pits. Also, tests would be made of geothermal fluids and gases to determine noxious, toxic, and radioactive qualities.

Development and Production

Surface drainage may be altered some to control surface runoff during rainstorms. Development drilling can be expected to penetrate the fresh water zones in the subsurface. In this event casings will

prevent the mixing of fresh and polluted water.

Water demand for geothermal operations varies with the size of the field and the type of power plant used. The water requirement for different phases of geothermal operations is summarized in Table 10. On the basis of our current understanding of geothermal development, an average geothermal field could consist of two to three power plants producing approximately 110 to 160 Mw per year. Therefore, assuming the use of an isobutane plant, a conservative estimate of water would range from approximately 6,200 acre-feet per year to 9,300 acre-feet per year of makeup water for an average field. Estimated minimum make-up water demand, assuming one isobutane power plant, would be approximately 3,100 acre-feet per year; estimated maximum makeup water demand, based on the development of a 700 Mw generating capacity using isobutane power plants, would be approximately 41,000 acre-feet per year. It is likely that the Kilbourne Hole KGRA is of fairly good geothermal resource potential. Based on the assumption that full development of the field will reach a 500 Mw generating capacity, the estimated makeup water requirement is approximately 30,000 acre-feet per year.

It is important to note that these cooling water requirements need not necessarily come from local surface reservoirs or water wells, but may be obtained wholly from produced geothermal waters. The final choice ofuse either local or produced water would depend on availability of local water and a comparison of the economics of each source.

Table 10 - ESTIMATED WATER DEMAND FOR GEOTHERMAL OPERATIONS

OPERATION	WATER DEMAND 1/
Exploration 2/	3.7 acre-ft/yr
Development 2/	3.7 acre-ft/yr
Power Plant Operation 3/	
Isobutane Power Plant	- 3,100 acre-ft/yr
Direct Steam Power Plant	+ 430 acre-ft/yr
Flashed Steam Power Plant	- 200 acre-ft/yr

1/ + Water in excess in Geothermal Operations

- Water required from either produced water or outside source.

2/ Assuming 20 producing wells required per power plant.

3/ Water demand on basis of a 55 MW generator and a well-head temperature of 405°F.

Close out

Precautions taken during development and production would protect the fresh water zones after the wells were plugged and abandoned. Revegetation and contouring the ground surface would control runoff so that no erosion problems would occur.

Living Components

Vegetation

The vegetation within the entire lease area consists mainly of a

shrub overstory with an understory of perennial and annual grasses and forbs. Some areas are covered only with grasses. The geothermal activities that may occur in any of the development phases will have some effect upon the vegetation.

Exploration

Each time a vehicle leaves an established road, vegetation is disturbed. Usually the tires crush or break off portions of the plants, thus leaving a dead, dying, or dwarfed vegetation within the tracks. These trails are conspicuous due to the uniform height of the surrounding vegetation. Future road developments may result in the clearing of this vegetation and the shaping, compacting, and sloping of the soils.

Drill pads may be cleared of vegetation while the area is leveled for the erection of drill rigs. Small mobile rigs do not need a cleared area due to the compact size of the rig. These small rigs usually drill shallow holes that take a day to complete. Some vegetation is damaged or destroyed in the 100 or so square foot area needed for these activities.

Large drill rigs used in drilling geological and exploration holes require a level drill pad. These areas are completely cleared of vegetation. The intense activities around the drill rig restrict vegetative regrowth. Fluids may be used in the drilling operation that restrict vegetative growth. Some of these fluids may be released into arroyos or sunken areas, thus eradicating other vegetation.

Development

During the development phase, development wells will be drilled. Vegetative removal is similar to that discussed under large rigs in the

exploration phase. A number of these wells must be drilled to supply enough energy to a power plant in the production of electricity. The Geysers field (dry steam) requires the steam energy from 10 to 20 wells in order to produce 110 Mw of electricity. In a hot water field in Mexico 19 wells are presently supplying enough energy to operate a 75 M_W power plant. Therefore, drilling will likely continue until the field is fully developed. Thus, each drill pad increases the total impact upon the vegetation within the lease area.

Pipelines will connect the producing wells with a power plant, and in the process, vegetation is either damaged or removed. The right-of-way for the pipeline is usually cleared of vegetation and a maintenance road may parallel the pipeline. Once the pipeline is constructed activities will be conducted upon the maintenance road and on portions of the pipeline that need attention. Therefore, the vegetative regrowth is hindered with the continued use of the area.

Power plants will be constructed in certain locations and vegetation will be removed from 5 to 10 acres of land. The constant activities around these plants will curtail the regrowth of vegetation. Also, soil sterilents may be placed upon the soils to eliminate vegetative growth.

The hot water system may have further impact on the vegetation. This system would probably contain a number of soluble compounds. Some of these compounds, such as excess amounts of sulfur, boron, and others, may inhibit the growth of vegetation. Pipelines may leak or break and bleed off from wells, or other accidents may introduce these compounds into the soil where it can be taken up by the vegetation of the area.

Certain non-condensable gases may be released into the atmosphere from steam and hot water systems. Some of these gases will affect vegetative growth. Hydrogen sulfide, carbon monoxide and other gases will be absorbed by vegetation. This may inhibit or eliminate vegetative growth.

Transmission lines will be required to transport electricity from the power plants. The construction of these lines will further disturb the vegetation within the powerline corridor. Large vehicles are needed to transport and erect the materials needed in powerline construction. A bladed road may result from the maintenance of the powerline, thus further vegetative disturbances result.

High voltage electricity itself may affect the growth of vegetation. Studies are being conducted in Montana at the present time to answer this question.

A small town or village may develop around the field office. This area will be cleared of vegetation to construct temporary living quarters, office space, etc. People living in the area may consider collecting some of the vegetation in the adjoining area to decorate and landscape their residences. Also, problems may develop with the introduction of exotic plant species. These plants may become established, invade and take over the range lands of the area.

Each activity within the development phase requires a road of some sort. These roads may be trails to drill pads or trails along pipelines used once in construction activities. Other roads within the area may include maintenance roads to well heads, pipelines, powerlines, power

plants, the field office, and the possible village. This large network of roads will disturb a considerable area of vegetation.

Production

Vegetation will continue to be impacted as long as any activity associated with geothermal development continues in this area. Pipelines will be needed to carry the energy source to the power plant. Extra plants must be constructed to produce the electricity from the geothermal energy source. Transmission lines will be constructed as long as the production of electricity increases to warrant construction. All of these activities will further disturb vegetation as discussed previously under the development phase. Impacts on the vegetation depend upon the expansion and development of this geothermal field.

Close out

Vegetation will again be impacted in the close out phase. Each drill pad will be rehabilitated with the best technology of the present time. If the geothermal field is ever completely abandoned all of the surface and subsurface installations will be removed. Pipelines, powerlines, maintenance roads, and other disturbed areas may have been rehabilitated either naturally or mechanically. This vegetation may again be disturbed or destroyed, depending upon what activity is required to recover these installations.

Animals

Various animal species may be disturbed, displaced, or destroyed during geothermal development. Alterations in vegetation may contribute to habitat losses. Some geothermal activities produce minimal impacts

while others may have maximum long lasting impacts.

Exploration

During pre-lease exploration some species of wildlife may be disturbed. Certain animals may be temporarily driven from their nesting or resting areas only to return once the disturbance has passed. Burrows and underground nests may be disturbed or destroyed by vehicles driving directly over them. Rabbits, coyotes, raptors, and other small animals may be shot during these exploration activities for recreation and food. The machinery used in this type of exploration produces enough noise to disturb certain animals. However, this disturbance would be short term.

Post-lease exploration would have a large impact upon wildlife. Impacts of the pre-lease exploration would intensify during post-lease exploration due to the increased activities and the larger equipment.

Large drill rigs will be set up to obtain information from exploration and geological holes. The presence of the drill rig in an area for a number of days or weeks and the noise produced by it may disrupt breeding, nesting, or other activities of certain animals. Mud pits may be present and, due to the lack of water in this area, some wildlife species will use these pits as a source of drinking water. Usually the water contains some oil products and occasionally chemicals used in drilling that may be toxic to animal life. These drill rigs operate 24 hours a day. Therefore, animals in the immediate area of the drill rig would be disturbed during the entire drilling operation. Some animals will become accustomed to the noise and activities.

Development

A number of drill rigs will be active in the area once exploration indicates an economical geothermal resource. The increased number of drill rigs would intensify the problem of wildlife impacts, as discussed under large rigs in post-lease exploration.

Pipelines will be constructed by clearing vegetation and traversing the land with vehicles. The lines are usually designed to cover the shortest distance possible; therefore, the line usually crosses roadless isolated lands. These activities will further disturb wildlife species. More dens and nests will be disturbed with vegetation removal and soil disturbances, both above and below ground. Some shooting of animals may take place for food or recreation.

Power plants also require the removal of vegetation and the leveling and compacting of soils. These activities further add to the impacts previously discussed.

Transmission lines will be constructed to carry power away from the power plants, although these transmission lines are now designed to virtually eliminate raptor electrocution. The towers provide excellent perches for birds of prey. Shooting of birds as they are perched on these towers remains a serious problem.

Roads will have a very large impact upon wildlife species. The increase in access will increase man's activities from both a working and recreational aspect. Areas that once were isolated will not be used by man and his machines. These activities may disturb breeding, nesting, resting, and associated activities. Some animals need isolation to

produce their young or just carry on their everyday activities. These species would probably move to other isolated areas.

Production

If the area is fully developed a very large area will be partially disturbed. This will, in turn, impact wildlife. Some species may be displaced due to these activities while other species may benefit. Hot water may be treated and used on the surface for irrigation, recreation, and possible watering of livestock and wildlife.

Close out

If close out takes place many localized areas may once again become isolated. Species that require isolation may again invade the available habitat. Rehabilitation may introduce new vegetation that produces a favorable habitat for new species or improve the present habitat so that animal populations may increase.

Ecological interrelationships

Geothermal developments will partially impact the various plant and animal communities within the proposed lease area. Localized ecosystems will change as development increases. These changes may be detrimental, such as animals moving out of an area due to changes in plant communities, air quality, or man's presence in an isolated area. These single component changes have been discussed earlier in their appropriate sections.

Micro-climates will be destroyed in localized areas at drill pads, pipeline rights-of-way, power plants, transmission lines, and roads. This in turn, disrupts the complete plant and animal relationship because plants are removed that are required for food, cover, and soil stability. Secondary succession is slow due to a lack of water and high

soil temperatures. Many times regression occurs instead of succession further changing and degrading the ecosystem.

Human interest values

Landscape character

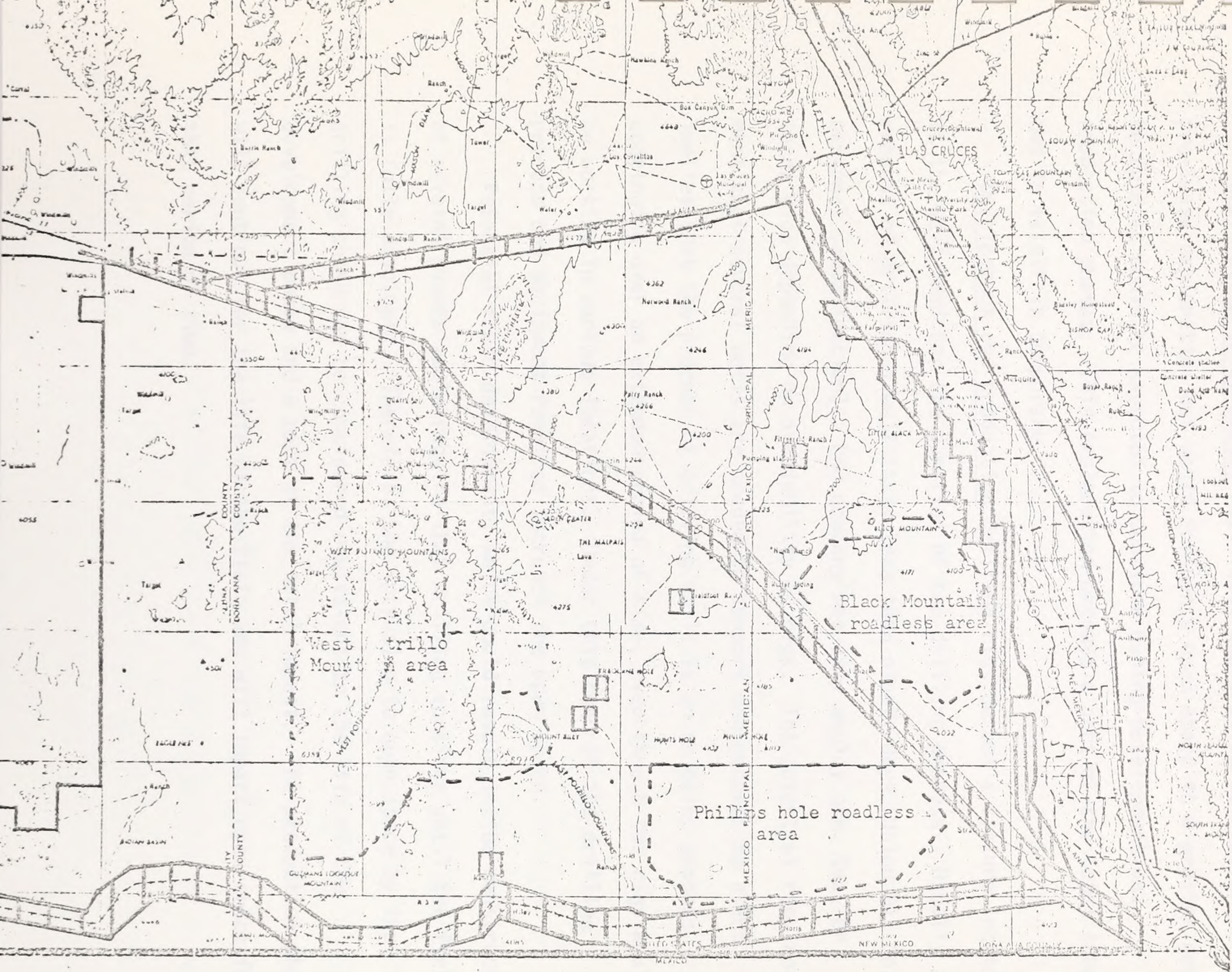
Open space

Open space is an area which provides minimum obstructions to movement and sight. The New Mexico Environmental Institute appraised the open space situation in the southwestern desert as a distinctive scenic feature. The proposed geothermal lease area can be subdivided into several areas where open space is dominant by segregating the railroad and electric transmission line corridors and the pipeline pumping station (Illustration 26).

Most generally, natural, as opposed to man-made features do not intrude open space except on a localized basis. The horizon is obscured from view in rare situations only, which contributes to a feeling of spaciousness. The West Potrillo Mountains have no man-made structures which intrude open space but the numerous mountainous formations close out distant horizons and reduce open space to a more localized situation. The natural formations of Kilbourne Hole, Hunt's Hole, the East Potrillo Mountains and Mount Riley cause similar localized situations when viewed from within the confines of the structures (Illustration 26).

Most of the remainder of the area considered in this document is dominated by low, rolling topography and vegetative cover that does not interfere with open space.

Exploration (pre-lease) Temporary intrusions, particularly those



OPEN SPACE VALUES WITHIN

THE KILBOURNE HOLE AREA

Illustration 26

facilities and units necessary to geothermal pre-lease exploration are considered detrimental to the open space characteristics of the area on a temporary basis only.

Exploration (post-lease) Post-lease exploration is similar to pre-lease exploration but would influence open space to a greater degree because it could be expected to continue during development and production phases. This exploration becomes a part of the total intrusion but in itself is temporary.

Development and production Drilling rigs become a fixture located at the well head for the duration of the drilling process. Usually the process of drilling a well lasts less than ninety days (Union Oil Co. personal communication). One company may only employ one, two, or three rigs depending on availability of rigs. The potential requirement that several wells are needed to support one generating plant implies that the process of drilling wells is an on going process continuing over an extended period of time, even though the rigs would be working in various locations. Under this concept the drilling process and equipment required intrudes the open space.

Potential field development, which could result in the construction of several plants would require that drilling continue until the field is fully developed. Therefore, the intrusion to open space by the drilling phase can be considered equivalent to the life of the development phase and a part of the total impact. The production phase will continue for the life of the field and will impact open space for that period of time.

Close out The close out phase begins sometime during the production phase. As well production declines the wells which no longer produce are phased out and shut down. Often the well can be replaced by another productive one close by. If not, the stature of the field is reduced. Close out then can be related to the life time of the productive area and can be gradual, partial or complete abandonment. Only in the case of complete abandonment, which would result in withdrawal of all fixtures, would the imposition on space be solved.

Scenic qualities Scenic values are affected by aesthetically undesirable intrusions. One aspect of the scenery is open space. It can be concluded that any intrusions which are visible and obtrusive would be detrimental to present values.

Man made structures invade the natural scene. Often the feature is acceptable aesthetically but it alters the situation. Subdivisions of the proposed lease area would be changed according to the stature of the area concerned; for instance, the West Potrillo Mountains and Mount Riley are unencumbered by man-made intrusions. Throughout the remainder of the proposed lease area intrusions are present which may, or may not, be detrimental to scenic quality, depending upon the viewer.

Exploration (pre-lease) Pre-lease exploration should not introduce significant undesirable intrusions unless roads are constructed along hillsides in order to get to otherwise inaccessible areas. The temporary nature of pre-lease exploration leads to the conclusion that scenic values will bear minimal influence during the process except on

a very localized basis and then for a short time only.

Exploration (post-lease) The natural scenic environment is intruded most significantly by drilling rigs and associated activity. At this time the general scenic situations begins to change. The rapidity and amount of change is dependent upon the magnitude of the exploration. Potentially, post lease exploration leads to resource development. In this way it is a part of the total scenic impact.

Development and production The development phase introduces facilities for the use of the geothermal energy producing electricity. This includes the plant complex as described previously. As these facilities develop, the natural native scenery is intruded. Curiosity arousing, eye catching aspects of natural scenery transfers to the man-made structures as they apply to the general scene. The development-production phase of geothermally produced electricity is expected to change the characteristics of the landscape and its natural scenic attributes.

Close out Gradual close out of a developed geothermal field would probably not contribute substantially to restoration of a natural setting. Total close out or abandonment of a single plant complex or of the entire development would restore an undeveloped, back-country atmosphere if all traces of man's activities were obliterated. The life time of a plant complex is expected to be 30 years or more. It is presumptuous to expect that a complete withdrawal or mitigation of all intrusions could be achieved; therefore, a lasting impact on the scenery can be expected.

Primitive values

One element in the evaluation of primitive values is the degree to which an area has been intruded by man-made facilities. Any form of action which requires entry into an area by vehicle greatly nullifies primitive values. A great amount of the area under consideration is low in primitive value because of roads, powerlines, a railroad and ranching activities. On the other hand, the West Potrillo Mountains and Mount Riley are free from intrusion except for two or three ranch trails and one better quality road which provides access to livestock water in the southern portion of the mountains. Primitive values here are higher than any other portion of the proposed lease area.

Other semi-roadless areas are the Black Mountain area and the Phillips's Hole area (Illustration 26). These areas are relatively flat, sand dune type desert country. Creosote bush dominates the Black Mountain area, and yucca mixed with mesquite bush dominates the Phillip's Hole area. Some desert grasses and annuals are found in both areas. Cattle grazing is the major use of both areas.

Exploration (pre-lease) Roads which may be formally constructed or made merely by driving over a surface in a manner which leaves tracks for someone else to follow will be detrimental to primitive values. Exploration of any kind which requires vehicular travel off existing roads will reduce primitive values. The larger the roadless area is, the greater the impact will be because the opportunity for isolation will be reduced.

Exploration (post-lease) Enchroachments upon primitive values will increase proportionately to exploration.

Development and production As development of a geothermal resource area progresses more primitive values are lost. Criteria for rating and establishing primitive values specifies that man's influence be minimal and capable of mitigation. (Can roads be removed from the area?) Development of the geothermal resource introduces roads, pipelines, power plants, transmission lines and people to the production area, destroying primitive qualities. This is due to the fact that production of electricity by geothermal energy must be accomplished on the site because the heated steam or water cannot be transported long distances as with oil and gas via underground pipelines.

Close out The shut down of a geothermal production area and complete removal of all traces of man's influence would be necessary to restore primitive values. (See residual impacts - primitive values.)

Land use

Casual use types of exploration will not result in significant impacts on present land uses. Casual use assumes the use of existing roads and trails by light vehicles during periods of stable soil conditions. Careless companies resorting to extensive cross-country travel could have a more significant environmental impact; however, it is assumed that stipulation and supervision by regulating agencies will control this use. The more intensive types of exploration operations could cause significant impacts. Only these intensive types of exploration methods are considered in the following discussions of impacts upon the various land uses.

Grazing

Exploration Grazing use would be moderately impacted due to livestock disturbance caused by vehicular traffic both on and off existing roads and trails, loss of vegetation from this travel and from drill site operations and possible straying of stock. Water discovered during drilling that could be used for livestock would be a beneficial impact.

Development Grazing would be moderately impacted during the development phase due to the loss of forage production, the disturbance of animals and interruption of the ranchers' routine operations. Grazing could not continue in the immediate area of development. If pipelines were not elevated at least 5 feet off the ground they could present a barrier to livestock movement.

Production Impacts on grazing use will continue during the production phase as more ground surface will be taken up by roads, well sites, pipelines, power transmission lines, generating facilities, and other needed facilities until the field is fully developed. Noise, human and mechanical activities, noxious gases, and fluids will also disrupt grazing use during this phase. While at the Geysers, the study team observed cattle grazing near well heads indicating they were not greatly disturbed by the production activities. Nevertheless, the facilities used in the production phase do inhibit livestock movement and reduce the quantity of forage available because of their surface occupancy.

Close out Adverse impacts during the abandonment of a geothermal field would decrease as noxious elements decreased and activity in an area declined. As roads and sites were rehabilitated, forage production may slowly increase.

Rights-of-way

Exploration Rights-of-way now in use would probably not be impacted.

Development Rights-of-way now present would not be adversely affected because they would have a prior right, but future rights-of-way would require some route adjustments if in conflict with development activities.

Production Present rights-of-way in the production phase would probably be crossed by power transmission lines carrying power from the generators to consuming areas. The present rights-of-way have prior rights that should be protected. There would undoubtedly be additional adverse impacts similar to those of major powerline operation of the 345 KV class from the new lines.

Close out The removal of pipelines, power transmission lines, and roads would eliminate conflicts with other rights-of-way.

Recreation

Exploration Recreation activities would be adversely impacted because geothermal activities would clash with the enjoyment of back country values, hunting, and week-end outings as previously described. Discussions under landscape character further amplify these impacts.

Development Recreation uses would be adversely affected in

the area of development activities because of noise, dust pollution, visual impacts in back country areas, wild game disturbance, and aesthetic intrusion as previously described. In addition, some access might be restricted due to geothermal field development which would require that a road be closed.

Production Present recreation use would be adversely impacted in a similar manner to the development phase. Visitor days would probably increase due to the introduction of a different and interesting type of development that people would want to see.

Close out All present types of recreation use would have beneficial impacts from the close out phase.

Mining

Exploration The mineral industry would be helped due to the geologic information gained on subsurface strata and minerals from geothermal drilling exploration.

Development Mining areas possibly would be diminished in size because geothermal development would preclude any conflicting mining activity. However,the general area is believed to be of low mineral value so this impact would be low. Development drilling would also reveal geologic data not otherwise available.

Production Impacts on mining would be similar to those occurring during the development phase.

Close out The abandonment of the field would have no effect except to open the developed area to other forms of mining.

Urban and suburban

Exploration Urban and suburban areas adjacent to the proposed lease area would benefit from new jobs and from information gained regarding possible new city water sources. The Anapra and Meadow Vista area is in need of a new source of potable water because present sources are saline.

Development The development phase would provide employment to nearby residents and generate additional money into these communities. Should good supplies of water for domestic use be found, communities in the Anapra and Meadow Vista areas would be greatly benefited. Urban-suburban expansion room could also be curtailed if development occurred in the path of expansion.

Production The populated areas adjoining the field would benefit from employment opportunities and possibly from cheaper electricity in homes and businesses. If the wells and production facilities were near these communities, adverse impacts from nauseous air vectors might be present.

Close out Any populated areas near a geothermal production field would benefit from the elimination of objectionable sounds and smells, however, it could be slightly impacted by the loss of jobs and cheaper electric power.

Archaeological Values

Exploration

Archaeological values are believed to be sparse. Pre-lease exploration would not be damaging to archaeological values unless the exploration inadvertently took place on an unknown site. This would

probably not happen because special stipulations in the "Notice of Intent" would lessen the possibility of such an occurrence. Post-lease exploration is similar to pre-lease exploration and the likelihood of the occurrence is further diminished by the fact that an archaeological survey is required to post-lease exploration.

Development and production

An archaeological clearance is required on sites prior to any development. Therefore, no damage to archaeological sites is expected.

Close out

Little additional impact on these values is probable. Most of the damage, if any, will occur during the development and production phases.

Other scientific values

Exploration and development

Other scientific values would be adversely affected to the extent that exploration took place in sensitive areas. Severe impacts are not probable during this phase.

Production

Most of the adverse impacts will have already taken place during the development phase, however, the continuation of human and mechanical activity would delay the healing of vegetation scars and the return of rare plants and animals to the ecosystem.

Close out

There might be beneficial impact in that botanical and zoological communities would be under less stress and would have a chance to rehabilitate themselves.

Other considerations

Public utilities

Exploration and Development

Public utilities would not be impacted if care is used to avoid present installations.

Production

The benefit of large amounts of supplemental electric power to public utilities in the area is obvious. Other utilities would not be affected significantly provided that the new transmission lines are located to avoid various interference problems.

Close out

No plant or animal impacts are anticipated. The closing of a field that supplied a public power utility would force the utility company to seek an alternate source of energy.

Population centers, planning and zoning

Exploration

Exploration activities within the planning and zoning jurisdiction of cities should have no significant effect. Planning and zoning should be conducted at this time so development in sensitive areas could be prevented.

Development

The development phase would call for the enforcement of planning and zoning regulations, if any. Some reevaluation might also be needed as more information was gained. For example, drilling might reveal production pollutants to be more or less severe than expected.

Production

The production phase of an area will be a time for refinement of planning and zoning regulations. Counties and cities at this time would benefit from their experience and should revise their regulations governing undeveloped geothermal areas within their jurisdiction.

Close out

The close out phase would call for surveillance of areas for compliance with rehabilitation regulations.

Possible mitigating measures

General

No geothermal developments have been surveyed or constructed within the proposed geothermal lease area at this time. "Plans for Exploration" (43 CFR 3210.2-(d) are now being requested from applicants applying for noncompetitive leases within the area. Therefore, a great deal of flexibility is available in the placing of pipelines, power plants, transmission lines, roads, and a possible work camp or village. Once the "Plans of Exploration" are received and reviewed, plans can be formulated on how the proposed development of this area may occur.

When the lease is issued, post lease exploration will begin after a "Plan of Operation" is submitted and approved for each competitive and noncompetive lease. The "Plan of Operation" will describe, in detail, the drilling activities to be conducted upon that leased land. Each well site must be examined by the BLM and USGS before any exploration can begin. At this time mitigating measures can be written into each drilling permit. Other permits or rights-of-way will be issued on pipelines, transmission lines, power plants, roads, and the possible village as they are required in a "Plan of Development". Mitigating measures will be written into these permits, or rights-of-way to further mitigate the impacts each facility produces. Once leases and permits are issued, a working agreement between the USGS, BLM, and the developing companies will effectively mitigate impacts and provide for examination of facilities during compliance checks. Standard stipulations are included on the lease.

To help insure that all environmental components are considered, and that related impacts are mitigated to the greatest extent possible, a discussion of each component will follow to assist BLM personnel in the preparation and enforcement of special stipulations. The standard and special stipulations will only be issued and enforced on national resource lands.

The following discussion will be used when considering special stipulations necessary to mitigate and protect the various environmental components during all geothermal activities.

Non-living components

Topography

All wells, pipelines, power plants, transmission lines, and roads should be constructed on level lands whenever possible to reduce impacts incurred in rough topography.

Soils

Soil compaction and accelerated erosion can be reduced when restrictions are made on the areas needed for drill pads and power plant sites; the width cleared of vegetation in pipeline rights-of-way; the amount of disturbance allowed on transmission line rights-of-way, and the number of service roads. The size of vehicles on certain soil types would be restricted due to compaction characteristics. Erosion control structures may be needed in certain areas where accelerated erosion will take place. All existing roads should be used to the fullest extent possible. Other roads will be required to increase access to drill rigs, power plants, pipelines, and transmission lines. There roads should be placed on soils that are suitable.

Roads should only be constructed to serve a useful purpose and not for the convenience alone.

The construction of facilities should be placed on soils that are suited for such developments. Soil sterilants should be restricted from use on BLM administered lands. The impacts caused by the movement of vehicles over open terrain during exploration could be mitigated by:

(a) Directing the vehicles single file over a route.

(b) Driving around large vegetation and critical topography.

(c) Requiring large tires.

(d) Requiring light trucks.

(e) Reducing the number of vehicles.

(f) Permitting only one or two vehicles to follow the same tracks over open terrain.

(g) Allowing exploration only when weather conditions are favorable.

(h) Requiring the construction of road barriers on critical areas to prevent further use.

(i) Allowing drill site leveling and clearing only for large drill rigs.

(j) Requiring steel mud pits for portable drill rigs.

(k) Restricting drill sites for large drilling rigs to a minimum space, by fencing reserve mud pits and by requiring a foot or two of bentonite lining in earth pits so fluids could not escape into the subsurface strata.

Slant drilling could be required when conditions are favorable.

Dangerous areas could be fenced. Proper disposal of all forms of waste could be mandatory. Pipelines and transmission lines could be buried where practical.

Reclamation of all areas should take place during abandonment of each facility and during final abandonment of the field.

Air

Air pollution may become a problem. Other agencies should be consulted that have the expertise and jurisdiction to deal with this problem. (EPA, etc.). New advances in air pollution controls may change the technology of geothermal development.

Particulate matter (dust) will rise into the air each time a dirt road is used. Dust could be controlled by sprinkling the disturbed areas with water periodically. The construction of black topped roads may alleviate some of this problem.

The use of explosives should be severely restricted and allowed only when conditions were favorable.

Blowout preventers should be required on drilling rigs. Exhaust emissions could be controlled by allowing only the required minimum number of combustion engines in an area at any one time.

Air quality levels should be monitored during geothermal activities. We could require that completed wells should not be allowed to vent to the atmosphere except at a certain rate.

During production the wells would need repair from time to time and in most cases this could probably be accomplished with truck or trailer mounted work-over rigs. The repair of a well would cause some air pollution because combustion engines would be used to power

the equipment and some gases would escape.

We could require periodic inspections of equipment, and all facilities that should reduce significantly the accidents which could pollute the air.

During the abandonment of the geothermal field, air pollution would diminish.

Water

Ranchers' stock tanks should be protected by locating operations away from those areas and by selecting locations so that an accidental escape of fluids would not eventually drain into their tanks.

Fresh water zones in the subsurface should be protected by running casing and cementing off these zones so contamination would be prevented.

Only water wells that have good recharge should be used as a source of water for drilling rigs.

All shallow exploratory holes should be drilled with air except where conditions require the use of mud.

Geothermal wells that produce excessive radioactivity, toxic or noxious fluids or gases should be shut in until the hazard could be eliminated.

Cooling towers used during production require large quantities of water. Rather than using fresh water from shallow zones in the subsurface, the waste water from geothermal production should be used if feasible.

Casing which was set through the fresh water zones and cemented should be left in place of if such casing was removed, the holes

should be properly plugged with cement to protect the fresh water zones.

Runoff from thunderstorms should be controlled by land contours and revegetation which would prevent erosion.

There should be proper disposal of waste fluids in sumps and pits.

Living components

Vegetation

The East and West Potrillo Mountains and the Aden Lava Flow have not been studied in any great detail as yet. They should be protected from development until a detailed vegetative survey is finished. Certain rare species may be present within these areas that are not found elsewhere, i.e., Torrie yucca-East Potrillo Mountains.

Wherever possible, vegetation should not be destroyed. When vegetation is removed a road grader can clear vegetation without as much soil disturbance as a bulldozer. However, certain actions may not require significant vegetative removal such as when constructing pipelines and transmission lines.

Waste fluids resulting from drilling operations should be contained to protect vegetation.

Animals

Stipulations which are needed to protect the soils and vegetation will likewise benefit animal habitats found within the area.

Special stipulations may be needed to protect wildlife. A list of endangered, threatened, and peripheral animals could be contained within the special stipulations attached to drilling permits.

The East and West Potrillo Mountains and the Aden Lava Flow should be inventoried and analyzed according to BLM procedures to determine in more detail the wildlife species and habitat present in these areas.

Ecological interrelationships

Properly enforced stipulations that provide protection for soils, air, vegetation, and animals will likewise mitigate impacts upon ecological interrelationships.

The BLM will monitor all construction of geothermal facilities on and across national resource lands to insure compliance with the terms and conditions of all drilling and special land use permits.

Each company could designate a field representative (liaison) whose responsibility it would be to communicate with an authorized representative of the BLM, and receive and comply with all communications and decisions of the BLM.

The BLM will reserve the right to require rehabilitation of all areas disturbed during construction and development of this area. This may vary from only reshaping to complete revegetation.

Prior to beginning construction, a pre-construction conference could be held between the BLM and each company to discuss and clarify all stipulations, terms, and conditions of each permit.

Human interest values

Landscape character

Open space and scenic values

Pre-lease exploration is authorized under a "Notice of Intent."

The temporary nature of pre-lease exploration and the type of equipment used is considered detrimental to open space for only a short time. Mitigating measures contained with the "Notice of Intent" are intended to reduce the impacts produced by pre-lease exploration.

Post-lease exploration is a more intensive survey of the area and may be mitigated as follows:

1. Service roads could be designed as to connect a number of sites with and through road thus reducing the large number of roads.
2. Service roads could be restricted to near level topography and not allowed across steep hills and mountains.
3. The amount of area covered by drill pads could be restricted.
4. Where possible drill rigs should not be skylined.
5. Drill rigs could be painted to blend with the surrounding landscape.
6. Drill rigs could be scattered out rather than confined, thus reducing the intrusions a number of rigs would produce in a small area.
7. All support facilities used as offices, temporary housing etc., could be designed and painted to blend with the landscape of the area.

In addition to the measures described in the post-lease section these mitigating measures may be considered in the production and development phases.

1. Pipelines could be confined to corridors within reason.
2. Pipelines could be painted to blend with the surrounding landscape.
3. Maintenance roads could be designed so that no blading is required in construction.
4. Power plants could be located in areas where the visual intrusion would be reduced.
5. Low profile power plants could be designed and painted to blend with the surrounding landscape.
6. Portions of power plants could be placed underground.
7. Transmission lines could be placed along existing corridors.
8. Transmission lines could be designed to reduce skylining.

Mitigation of impacts usually occurs along with any close out phase whether it is the shut down of a well, or abandonment of a plant complex. The objective should be to restore the setting to a natural, open space, condition. This would require that all facilities and fixtures, which intrude open space, be removed.

Mitigation of scenic impacts during a close out phase should be directed toward restoring as much of the natural setting as possible. The situation may require that another plant community be introduced temporarily. This would include plowed and seeded areas, vegetative planting and replacement of rock structures or hillside rehabilitation. Each action could be designed to promote natural succession, ultimately reproducing the native scene.

Primitive values

Mitigation of impacts resulting from pre-lease exploration would

probably apply to areas not previously traversed by vehicles (Illustration 26). Attempts could be made to gather data without the use of vehicles in areas away from existing roads. When entry into the remote areas becomes necessary, it could be done on a selective basis with additional attention being given to location of the road. It may be possible to retain primitive values if roads or other lasting impacts are obliterated when exploration is completed.

The "Plan of Operation" should clearly identify methods of post-lease exploration and location of intended exploration. Primitive values can be preserved by reserving areas of highest quality.

An area committed to geothermal development will be subject to known methods of developing the subterranean resource. These methods include drilling for the heated steam or water and then piping it through a conglomerate of different sizes of gathering pipes to an electric generating plant. Most likely the pipes will be above ground. Several wells will probably be needed to support one generating plant. If the geothermal resource proves capable of supporting several plants the area of intrusion could be quite large and the impact on primitive values could be extensive.

Mitigating the impacts of the development production phase requires day to day analysis and adjustments within the industry capabilities. Consideration can be given to plant location and the number and alignment of the pipelines. Transmission lines should follow corridors avoiding natural areas as much as possible.

The close out phase comes at a time when maximum intrusion has been made upon an area. To restore the area to a condition which

exists today may not be practical; sometime in the future, however, every effort should be made.

Land uses

Grazing

Possible stipulations to mitigate impacts under all phases of geothermal activity are as follows:

1. Limit vehicle use by exploration crews to dry soil conditions to minimize forage damage.
2. Encourage pooling of information by companies so that numerous companies do not travel over the same land for the same purpose.
3. Encourage fence crossings to be made at regular gates. New cattleguards or gates that are necessary should be installed to BLM specifications.
4. Make companies responsible for their employees actions relating to the control of cattle harassment, vandalism and unauthorized use of livestock improvements.
5. Fence mud pits and any other areas of danger to livestock.
6. Limit access roads, drilling pad size, pipeline rights-of-way and other facility sites to the minimum area necessary and require rehabilitation where feasible.
7. Require safe disposal of noxious fluids.
8. Require adequate noise mufflers.
9. Rehabilitate all abandoned rights-of-way and sites by reseeding, installing water bars and other measures as necessary.

Rights-of-way

1. Existing rights-of-way should be protected from geothermal activities.
2. Require rights-of-way corridors where possible for all future utilities.

Recreation

Recreation in the proposed lease area includes among other things: driving for pleasure, sightseeing, hunting, motorcycling, rockhounding, plant collection, zoology, hiking, mountain climbing, and pleasure driving of dune buggies and 4-wheel drive vehicles.

Other sections of this report have cited impacts which are felt to be detrimental to recreation values. Possible mitigating measures in those sections should be adhered to in order to protect the recreational resources. In addition,special attention should be given to the needs of the recreationist and his right to use the public land. His access should not be restricted unless there is some danger to him or to the geothermal production activity.

Mining

All existing valid mining claims, material sales sites, and mineral leases shall be protected as provided in Public Law 585.

Urban and suburban

Recommendations to mitigate impacts of actions which are felt to be detrimental to the general public and/or urban suburban growth which are cited in previous sections of this report should be adhered to (air, water, etc.). Roads and other access routes for

geothermal development should also serve residents of the Mesilla Valley or other nearby areas. All environmental pollution from geothermal operations that could reach urban and suburban areas should be controlled to acceptable standards.

Archaeological values

Archaeological sites should be protected against any destruction from geothermal activities.

As long as there is some flexibility in the location of activities which modify the surface, there should be no difficulty in avoiding cultural resources. In order to adequately protect cultural resources in the geothermal area, intensive surveys must be performed before any surface modification occurs.

Other scientific values

Areas with these values should be avoided by all geothermal activities.

Other considerations

Public utilities

Public utilities should be protected from impacts as provided for by BLM policy and regulations from geothermal activities.

Population centers, planning and zoning

Companies could be required to submit a "Plan of Development" to county and municipal planning and zoning boards.

Alternatives

1. Limit the acreage to those areas which are less environmentally sensitive until further geological information is gained to determine potential of the subject area.

A portion of the total area described in this analysis is considered to be more environmentally sensitive than the rest of the area. These lands are located in the West Potrillo Mountains. The alternative is an acceptable alternative in this case and should be implemented.

The lands described above are in the western portion of the proposed lease area and make up a total of about 10 percent of the area considered in this report. They include the West Potrillo Mountains which are considered to have important primitive qualities.

Most interest shown by industry in the potential lease area has centered on the lands close to Kilbourne Hole. If these lands are leased first and exploration shows that the geothermal resource in the area near Kilbourne Hole is sufficient to indicate that the West Potrillo Mountains most likely would produce geothermal resources, the lands withheld at the time of the initial leasing could then be reconsidered for lease.

Much of the technology to produce electricity from geothermal energy sources is being developed now, indicating that potential geothermal sources produce, not only a source of energy to run electrical plants, but information and techniques as well. Thorough consideration of environmental values will provide feasible constraints to protect the environment within the capability of today's technology.

2. Withhold the entire area from leasing until further information is gathered.

If no leases were let, we would not be concerned about the impact of geothermal development on open space. However, since geothermal energy has proven to be a source of energy for operating electric plants and the Kilbourne Hole area possibly contains this type of energy, it is not in the best interests of the country to decline to lease. To delay the proposed action while awaiting additional environmental, geologic, and technologic information would probably mean a delay of years.

To decline to lease the potential geothermal area would mean that no intrusions would be placed on the land. This would be contrary to a policy of developing energy resources.

To delay leasing would delay obtaining information regarding geothermal resources that lead to better technology as well as postpone the production of electricity which is greatly needed at this time.

3. Do not lease any of the subject area.

This would be contrary to the President's second energy message and the Steam Act. If no leases in the Kilbourne Hole area are made, the energy which could come from the area would have to be supplied from other sources. Geothermal energy could contribute substantially to the overall demand for energy. To decline to lease would not be in the best interests of this nation.

Recommendation

This analysis was prepared to evaluate the feasibility of a geothermal leasing program in the Kilbourne Hole area. This environmental analysis indicates there are sensitive lands within the proposed lease area which should be further protected. The following recommendation is made to protect the primitive character of the West Potrillo Mountains while allowing exploration to continue in less sensitive areas. In the event that geothermal resource is discovered in surrounding areas, this recommendation and the environmental impacts relating to the West Potrillo Mountains will have to be reassessed. The recommendations that have been made on the leasing program within the Kilbourne Hole area are as follows:

1. No leases should be made on lands that lie within the West Potrillo Mountains in order to protect the primitive values. These lands are described as being in:

T. 25S., R. 3W., NMPM
Sec. 31, 33: All
T. 26S., R. 3W., NMPM
Sec. 3-11, 14: All
15: Lots 1-12
17-23: All
26: E½, SW¼
27-31, 33-35: All
T. 26S., R. 4W., NMPM
Sec. 1, 12, 13, 24, 25: All
T. 27S., R. 2W., NMPM
Sec. 28: E½
29-31 All
33: E½
T. 27S., R. 3W., NMPM
Sec. 3-11, 14, 15, 17-23, 25-31, 33-35: All
T. 27S., R. 4W., NMPM
Sec. 1: Lots 1-4, S½NW¼, S½
12, 13, 24-27, 34,35: All

T. 28S., R. 2W., NMPM
Sec. 5, 6: All
T. 28S., R. 3W., NMPM
Sec. 1, 3-9: All
16: NE¼
17-21, 28-31, 33: All
T. 28S., R. 4W., NMPM
Sec. 1,3,10-15, 22-27, 34, 35: All

2. Studies to determine unique vegetative, wildlife, and ecological values in the Aden Lava Flow and East Potrillo Mountains are tentatively scheduled for completion in the fiscal year 1976. Until these studies are completed, surface occupancy will be denied on the following lands. Upon completion of these studies, surface occupancy may or may not be allowed, depending upon the findings. These lands are described as:

Aden Lava Flow

T.25S., R. 2W., NMPM
Sec. 27: S½
28: SE¼SE¼
33: E½, E½W½
34: All
35: W½NW¼, S½
T. 26S., R. 1W., NMPM
Sec. 6: Lots 4-7, E½SW¼
7: All
8: W½, SE¼
9: SW¼SW¼, S½SE¼
10: S½SW¼, NE¼SW¼
11: S½SW¼
14: W½, SE¼
15, 17, 18: All
19: NE¼, E½NW¼, NE¼SE¼
20: N½, NW¼SW¼, SE¼SE¼
21, 22: All
23: W½E½, W½
26: NW¼
27, 28: All
29: E½
33: N½, N½SW¼
34: N½N½

T. 26S., R. 2W., NMPM
Sec. 1, 3, 4: All
5: S½NE¼, E½SW¼, SE¼
8: E½NE¼, NW¼NE¼
9: N½, E½SW¼, SE¼
10-15: All
22: E½
23: W½E½, W½
26: W½E½, W½
27: E½
34: NE¼NE¼
35: N½, N½SE¼

East Potrillo Mountains

T. 27S., R. 2W., NMPM
Sec. 34, 35: All
T. 28S., R. 1W., NMPM
Sec. 19: Lots 1-4, E½W½
30: Lots 1-4, E½W½, SE¼
31: All
T. 28S., R. 2W., NMPM
Sec. 1: Lots 3, 4, S½NW¼, SW¼
3: All
4: Lot 1, SE¼NE¼, SE¼
9: NE¼
10, 11: All
12: W½
13, 14: All
15: NE¼
23-25: All
26: E½
T. 29S., R. 1W., NMPM
Sec. 6: Lots 1, 2, NE¼, E½NW¼

3. Special stipulations should be required to protect all known and unknown archaeological sites. Although the standard terms and conditions of the lease provide for protection of archaeological values, the following additional stipulations are recommended to help insure their proper identification and protection.

a. A certified archaeologist acceptable to the Authorized Officer (District Manager) must prepare the certified statement on archaeological values as described in Sec. 18

of the Geothermal Resource Lease Form.

b. The Authorized Officer (District Manager) retains the prerogative to require the protection of all archaeological values located on the lease area by requiring a change in the "Plans of Operation" or the "Plans of Development" to avoid archaeological values, or he may require the lessee to have the archaeological sites excavated and salvaged by a qualified archaeologist(s) prior to proceeding with operations.

Archaeological sites are known to occur on the following lands.

T. 23S., R. 1W., NMPM

Sec. 26: SE¼SE¼
33: N½NE¼

T. 24S., R. 1W., NMPM

Sec. 22: W½
26: SE¼SE¼
31: S½N½, N½SW¼
32: NW¼
35: E½E½

T. 24S., R. 2W., NMPM

Sec. 4: Lots 3-4, S½NW¼, SW¼
5: Lots 1-4, S½N½
6: Lots 3-7, SE¼NW¼, E½SW¼
7: SE¼
8: SW¼
35: S½

T. 24S., R. 3W., NMPM

Sec. 3: Lots 8-12
9: SW¼
10: S½S½
15: All
21: NE¼

T. 25S., R. 2W., NMPM

Sec. 13: SE¼
24: N½NE¼
27: E½

T. 25S., R. 3W., NMPM

Sec. 11: All

T. 26S., R. 1W., NMPM

Sec. 11: SE¼SW¼
14: NE¼NW¼

T. 26S., R. 3W., NMPM

Sec. 15: Lots 1-4, 7-10
21: Lots 1-8
28: W½
33: Lots 4-5, W½NW¼

T. 27S., R. 1W., NMPM

Sec. 7: S½SE¼, SE¼NE¼
10: W½NW¼, SW¼NW¼
15: W½NW¼
16: SE¼SE¼NW¼, SW¼SW¼NE¼, NW¼NW¼SE¼, NE¼NE¼SW¼
17: S½, S½N½
18: NE¼
27: SE¼SE¼
29: S½
31: NE¼NE¼
32: NW¼NE¼, NE¼NW¼
34: E½NE¼
35: S½S½N½, N½N½S½

T. 27S., R. 2W., NMPM

Sec. 29: SW¼SW¼
31: NE¼NE¼
34: N½SW¼,S½NW¼, SW¼NE¼, NW¼SE¼

T. 27S., R. 3W., NMPM

Sec. 5: Lots 1-2, S½NE¼, SE¼
8: W½

T. 28S., R. 1W., NMPM

Sec. 31: Lots 3-4, E½SW¼, N½SE¼, S½NE¼

T. 28S., R. 2W., NMPM

Sec. 8: NW¼
19: SW¼NW¼, NW¼SW¼

T. 28S., R. 5W., NMPM

Sec. 22: SW¼SW¼
27: NW¼
28: E½

T. 29S., R. 1W., NMPM

Sec. 2: SW¼
5: N½N½
6: Lots 1-4, E½W½, W½
7: Lot 1, NE¼NW¼
11: N½N½

T. 29S., R. 2W., NMPM

Sec. 1: S½, S½N½
2: N½
3: S½
12: NE¼NE¼

T. 29S., R. 3W., NMPM

Sec. 1: S½S½
12: N½N½
13: Lots 1-2

T. 29S., R. 4W., NMPM

Sec. 6: Lot 1,NE¼NW¼

T. 23S., R. 1E., NMPM

Sec. 28: SW¼, SW¼NW¼
29: E½NW¼, W½NE¼

T. 24S., R. 1E., NMPM

Sec. 13: Lots 10-11, N½SW¼
18: Lots 7-8, E½SW¼, SE¼
19: NW¼NW¼

T. 25S., R. 1E., NMPM

Sec. 27: N½N½

T. 25S., R. 2E., NMPM

Sec. 31: SW¼NW¼
33: S½
34: SW¼

T. 26S., R. 1E., NMPM

Sec. 1: All
10: SW¼, N½SE¼
11: NE¼NE¼
12: NW¼NW¼

T. 26S., R. 2E., NMPM

Sec. 6: S½

T. 27S., R. 1E., NMPM

Sec. 30: Lots 3-4, E½SW¼, SE¼
31: Lots 1-2, E½NW¼, NE¼

T. 28S., R. 1E., NMPM

Sec. 13: SE¼
24: NE¼
25: NW¼
26: SE¼

T. 28S., R. 2E., NMPM

Sec. 6: Lots 6-7, E½SW¼, SE¼
7: Lots 1-4, E½W½
18: Lots 1-2, E½NW¼

The lease gives the lessee the right to explore and develop the geothermal resource, but as development occurs, all existing regulations of the land managing agencies must be followed. Stipulations to mitigate the impacts of each action taken on the leased land will be formulated by on the ground examinations. A discussion of this procedure follows.

General stipulations will be attached to each permit or lease issued for any type of geothermal activity conducted on national resource lands within the Kilbourne Hole proposed lease area. These

stipulations are contained within Title 43 Code of Federal Regulations group 3200, Title 30 Code of Federal Regulations part 270, Geothermal Resource Operational Orders, and the lease agreement. (see appendix E)

These general regulations define methods and procedures that must be followed to protect the environment and insure proper and prudent uses of the national resource lands. The BLM and USGS are responsible for compliance with the regulations.

The following sequence of procedures and events takes place when a geothermal potential resource area is considered for development. The sequence is noted here to show the steps that are taken to develop the resource and the opportunities the agencies have to mitigate impacts.

Measures available to mitigate any environmental impact.

1. Application for geothermal resources leases are filed during a simultaneous filing period with the appropriate Bureau of Land Management office. "Notice of Intent to Conduct Geothermal Exploration Operations" are issued to applicants for geophysical exploration. General and special stipulations are included within each notice for that particular parcel of land.

2. The surface management agency,in turn, prepares an Environmental Analysis Record (EAR) to determine the environmental impact of issuing a geothermal resource lease.

3. The EAR will show the need for any special conditions and stipulations applicable to a general area subject to leasing to mitigate any potential impacts on the environment. The EAR will also

determine whether the proposed action constitutes a significant effect on the environment in the sense of NEPA section 102(2)(c).

4. The lease with special stipulations attached may then be offered to the applicant (non-competitive) for acceptance and execution.

5. The lessee must submit a "Plan of Operation" pursuant to the requirements of 30 CFR 270.34. Before commencing any operations on the leased lands, the "Plan of Operation" must be approved by the Area Geothermal Supervisor and the appropriate land management agency.

6. The USGS must prepare an Environmental Analysis (EA) covering the specific site of the proposed operation. Generally the proposal is to drill one or more geothermal resource exploratory wells. An on-site inspection with representatives of the lessee, USGS and the land management agency is then conducted to assess the potential impact of the proposed operation.

7. The "Plan of Operation" and a draft EA is presented to the Geothermal Environmental Advisory Panel (GEAP). GEAP advises the area Geothermal Supervisor on the environmental aspects of the "Plan of Operation" and recommends mitigating measures to protect the environment.

8. The EA is completed after input is obtained from GEAP.

9. The "Plan of Operation" is then jointly approved by the Area Geothermal Supervisor and the appropriate land management agency after including any special conditions or stipulations deemed necessary to protect the environment.

10. The lessee's application(s) for "Permit to Drill" (Form 9-331C), including any special stipulations as well as Geothermal Resources Operational (GRO) Order No. 2, is then issued to the lessee.

11. The lessee may then commence only those operations authorized under an approved "Plan of Operation".

12. The lessee's authorized operations are continuously monitored and inspected by the Area Geothermal Supervisor to ensure that the lessee complies with the applicable regulations, etc.

13. Any additional exploratory operations proposed by the lessee require another "Plan of Operation" pursuant to 30 CFR 270.34 resulting in a procedure essentially similar to steps 5 through 12 above. This resultant procedure may entail the addition of other special stipulations to protect the environment.

14. The lessee having finished the exploratory phase may now desire to enter into the development phase. However, no development operations can commence until the lessee has submitted a "Plan of Development" pursuant to the requirements of 30 CFR 270.34.

15. The "Plan of Development" covers the drilling and completion of development wells, but not the production thereof. Subject plan requires joint approval by USGS and the appropriate land management agency as well as an Environmental Analysis prepared by the USGS. The Geothermal Environmental Advisory Panel again recommends mitigating measures for protection of the environment which may result in additional special stipulations imposed on the lessee.

16. The lessee may then commence only those development operations

authorized under an approved "Plan of Development" and only then in compliance with all applicable regulations, stipulations, GRO orders, et cetera.

17. Prior to placing the subject wells on prolonged production the lessee, pursuant to 30 CFR 270.34 (k), must collect data concerning the existing air and water quality, noise, seismic and land subsidence activities and the ecological system of the leased lands.

18. Additionally, the lessee, pursuant to 30 CFR 270.76, must submit an annual report of compliance with environmental protection requirements giving therein a full account of the actions taken in said regard.

19. However, before a lessee can place wells on prolonged production, there must be a facility to utilize such production whether it be for power generation, or otherwise. The use of the leased lands or other Federal lands will be authorized only under a separate permit issued by the appropriate agency for that specific use and subject to all terms and special conditions and stipulations which it may include in that permit pursuant to 43 CFR 3200.0-8(a).

20. An Environmental Analysis is a prerequisite to the issuance of a permit for the use of the leased lands or other Federal lands for a power generation plant or other facility.

21. The granting of a permit pursuant to 43 CFR 3200.0-8(a) is not a license to construct a power generation plant. The construction, operation and maintenance of a power generation plant can only be accomplished by obtaining a "Certificate of Public Convenience and Necessity." Said certificate is granted by the Public

Utilities Commission of the State having jurisdiction and regulatory authority over the utility making application for subject certificate.

22. The utility making application for a "Certificate of Public Convenience and Necessity" may, depending upon the particular State's environmental protection regulations, have to submit an environmental impact statement in support of its application.

23. Stipulations for protection of the environment resulting from the construction and operation of a power generation plant and necessary transmission lines are imposed at this time.

24. Provided that all the foregoing steps can be accomplished without a significant effect on the environment, and in compliance with all applicable regulations, stipulations, GRO Orders, etc., the public utility can construct its power generating station and the lessee can enter into the production phase.

25. Plugging and abandonment of geothermal wells must be done in accordance with Geothermal Resources Operational (GRO) Order No. 3.

26. Surface restoration, rehabilitation, etc., is required of the lessee by the lease terms (Section 23, 30 CFR 270.45, 43 CFR 3204.1 (1) and GRO Order No. 4.

Residual impacts

Non-living components

Topography

Road construction and geothermal developments in the rougher terrain of the mountains and lava flow may result in localized changes in the land surface which cannot be mitigated.

Casual use, exploration operations and exploration drilling with large drilling rigs for geothermal resource would have only a temporary impact in most circumstances. If deep test holes were drilled in hilly or mountainous country, the cuts and fills for roads and drill pads would be permanent scars in many cases; therefore, if a plan of operation was submitted in such an area, the utmost consideration would be given to mitigate and avoid any residual impacts. Drill holes and road locations are usually flexible and can be moved short distances to avoid permanent scars. Also, permanent impacts could result if production caused surface subsidence. If precautions, such as reinjection of waste fluids into the geothermal reservoirs, are taken early this impact would not be expected to occur.

Soils

Soil compaction and accelerated erosion will result from vehicular travel and geothermal developments. The amount of compaction and erosion will depend upon the physical characteristics of each soil type and the extent of the disturbance. Many of these areas will heal themselves with time, while other areas will never heal. Roads that are not closed will be a continuing impact upon soils.

Living components

Vegetation

After the geothermal field has been abandoned and all disturbed areas have been revegetated, residual impacts could be the introduction of exotic plant communities and/or areas of unsuccessful revegetation. Also, any watershed changes may produce residual impacts.

Animals

Any remaining intrusions that interfere with the animal habitats or habitat after abandonment would be a residual impact.

Ecological interrelationships

If ecosystems within the proposed lease area are disrupted or destroyed, ecological interrelationships will have residual impacts.

Human interest values

Landscape character

Open space

If any facilities which encroach upon open space are left after the goethermal field is abandoned, there would be a lasting effect on open space; also, some natural or mechanical revegetation may tend to close up areas which would not otherwise be encumbered.

Residual impacts on open space, however, are not expected to be significant.

Scenic quality

Residual impacts will be those changes in values that cannot be mitigated. If it is desirable and feasible, the process of rehabilitation could, in time, restore most present scenic qualities.

Primitive values

Lasting impacts of geothermal development will probably be greater on primitive values than any other resource. The prelease and postlease exploration phases can most likely result in minimal residual impact. The reason for this is that these activities are considered temporary in nature. It is questionable whether roads that are left as the result of exploration can be restored to natural conditions. The development-production period usually spans several decades, impacts on primitive values are more permanent in nature and could become fixed as in the case of a community which may rise in support of the complex. Residual impacts could vary considerably depending upon the amount of development and the size of the area covered.

Land uses

Grazing

This general area suffers from a shortage of stock water and long range benefits could occur from stock water discoveries in the drilling of wells. No significant forage loss should result after rehabilitation.

Rights-of-way

Residual impacts on rights-of-way should not be significant.

Recreation

Residual impacts on present recreation values are dependent upon the degree of rehabilitation at the time the geothermal field is abandoned. It may be desirable to retain some roads, wildlife water holes or other facilities which aid outdoor recreation. These would be beneficial residual recreation impacts.

Mining

Residual benefits would result because of the geologic information gained from drilling.

Urban and suburban

There will be a loss of jobs by nearby residents as the field is closed out. The air quality will improve. A new source of water may supply the urban-surburban areas. Consumers of the geothermally produced electricity would have to look for another source of power.

Archaeological values

If adequate care is exercised prior to and during abandonment of the geothermal field, cultural resources will suffer no residual impacts.

Other scientific values

Ecosystems that were impacted by geothermal activities will tend to recover. Some isolated spot locations may possibly be lost forever.

Other considerations

Public utilities

Public utilities using electric power from a plant being closed out would have to secure a new power source.

Population centers, planning, and zoning

No significant residual impacts are anticipated.

Relationship between short term use and long term productivity

Historically, the lands in the proposed leasing area have been used for livestock production. In recent years public recreation interest in the area has increased due to expanding populations and recreational opportunities available on national resource lands. Public interest is primarily confined to primitive, cultural, scenic and open space values and general leisure use of the lands for a variety of participant activities. Off-road vehicle use, rockhounding and hunting are major participant uses.

Significant geothermal development throughout the potential leasing area would probably immediately affect the livestock and wildlife forage resources as well as recreational resources and opportunities. Major effects would be reduced forage, habitat, and recreational values, plus soil disturbance, noise and air pollution.

Consumptive, yearround water use is confined to ground water and is used by livestock, wildlife, and ranch families. In the West Potrillo Mountains, some rain water is impounded for livestock use. The need for water for geothermally produced electricity in this area has not been determined; however, if full scale development takes place and is dependent upon present sources of water, these sources could be depleted.

If exploration does not result in the discovery of a significant geothermal resource, the short term loss of grazing, wildlife habitat, recreational resources, water resources and other values would be minimal and the long term productivity of these resources will not be greatly affected.

Irreversible and Irretrievable Commitment of Resources

If a geothermal resource is fully developed and committed to the production of electricity, the resource could be exhausted completely. This would be an irreversible and irretrievable commitment of the resource. However, knowledge of geothermal reservoirs is limited at this time and it may be that the geothermal resource is rechargable in this area.

If geothermal production resulted in slipage along fault lines deep within the earth and subsidence of the ground surface, the alterations caused by these adjustments would be irreversible and irretrievable.

The primitive values, scenic qualities and open space values of the Kilbourne Hole area may be permanently degraded if the geothermal resource is completely developed in the proposed lease area. The primitive character of the West Potrillo Mountains would be the most impacted area with less serious degradation in the East Potrillo Mountains and the Aden Lava Flow. The entire development area in general would suffer permanent degradation because of the degree of surface disturbance and alteration.

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INTENSITY OF PUBLIC INTEREST

Four public meetings were held as part of BLM's Las Uvas land use planning process (URA-MFP), at which time discussion of the proposed lease action occurred and both oral and written comments were invited. Later a panel, elected by persons attending the public meetings, met with the District Manager and members of his staff to review and resolve conflicts pertaining to multiple use recommendations. Representatives of other governmental agencies were assembled for the same purpose. News media representatives attended the public meetings (see Appendix G).

The proposal to issue leases for the purpose of geothermal development was well received by most of the public attending the meetings. Oppostion was confined primarily to location of the lands to be leased and not to developing geothermal resources in the area. When it was explained that it was being recommended that some lands were being withheld from leasing and others should be withheld from surface occupancy, most resistance subsided. (See written comments - Appendix G).

RECOMMENDATIONS FOR ENVIRONMENTAL STATEMENT

The findings of this environmental analysis based on the written and oral recommendations received from the public meetings held in conjunction with the Las Uvas Planning Unit management framework plan, indicate that the degree and intensity of public concern for environmental values, except for the lands which are to be excluded or those requiring special protective stipulations (see "Recommendations"), has not been significant. One written comment, however, in support of an Environmental Impact Statement has been reviewed. An Environmental Statement for the Department of Interior geothermal leasing program was prepared in 1973, in compliance with Section 102 (2) of the National Environmental Policy Act of 1969.

In view of the public interest exhibited and the ability provided by law and agencies policies to mitigate impacts, the preparation of an Environmental Impact Statement is not recommended.

Reassessment of Environmental considerations in the West Potrillo Mountains should be made if discovery in surrounding areas indicates that geothermal resources within the area withheld from leasing are significant.

Participating Staff

Las Cruces District BLM

Gary McVicker - Area Manager
Kirby Kline - Outdoor Recreation Planner
Bob Anderson - Realty Specialist
John Grensten - Surface Protection Specialist
Bob Calkins - Environmental Coordinator
Bill Tipton - Geologist
Bill McMahan - Wildlife Biologist

New Mexico State Office

J. L. Querry - Geothermal Specialist
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U. S. Geological Survey

Barry Boudreau - Geologist
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U. S. Fish and Wildlife Service

Art Kinsky - Wildlife Biologist
Don Rodgers - Wildlife Biologist

Submitted by:

Geothermal Environmental Analysis Report Team - Kilbourne Hole area

Gary McVicker - Team Leader
Kirby Kline
John Grensten
Jim Querry
Bob Anderson

Accepted by:

W K Barker

W. K. Barker
District Manager

APPENDIX A

Title 43—Public Lands: Interior

CHAPTER II—BUREAU OF LAND MANAGEMENT, DEPARTMENT OF THE INTERIOR

SUBCHAPTER C—MINERALS MANAGEMENT (3000)

[Circular 2356]

GEOTHERMAL RESOURCES

Leasing on Public, Acquired and Withdrawn Lands

PART 3000—MINERALS MANAGEMENT; GENERAL

1. Section 3000.0–5 of Subpart 3000, Chapter II, Title 43 of the Code of Federal Regulations is revised to read as follows:

§ 3000.0–5 Definitions.

As used in this subchapter:

(a) "Leasable minerals" means oil and gas. (1) Gas means any fluid, either combustible or noncombustible, which is produced in a natural state from the earth and which maintains a gaseous or rarefied state at ordinary temperature and pressure conditions. (2) Oil or crude oil means any liquid hydrocarbon substance which occurs naturally in the earth, including drip gasoline or other natural condensates recovered from gas, without resort to manufacturing process.

(b) "Other leasable minerals" means (1) Coal, chlorides, sulphates, carbonates, borates, silicates, or nitrates of potassium and sodium; sulphur in the States of Louisiana and New Mexico; phosphate; and native asphalt, solid and semisolid bitumen and bituminous rock (including oil impregnated rock or sands from which oil is recoverable only by special treatment after the deposit is mined or quarried); (2) solid (hardrock) minerals; minerals in acquired lands which would be subject to location under the U.S. mining laws if located in the public domain lands.

(c) "Secretary" means the Secretary of the Interior or any person duly authorized to exercise the powers vested in that officer.

(d) "Director" means the Director of the Bureau of Land Management or any person duly authorized to exercise the powers vested in that officer.

(e) "State Director" means the Director of a Bureau of Land Management State office or any person duly authorized to exercise the powers vested in that officer.

(f) "Authorized officer" means any person authorized by law or by lawful delegation of authority in the Bureau of Land Management to perform the duties described.

(g) "Proper BLM office" means the Bureau of Land Management office having jurisdiction over the lands subject to the regulation where the term is used.

(h) "Public domain lands" means original public domain lands which have never left Federal ownership; also, lands in Federal ownership which were obtained by the Government in exchange for public lands or for timber on such lands; also original public domain lands which have reverted to Federal ownership through operation of the public land laws.

(i) "Acquired lands" means lands which the United States obtains by deed through purchase or gift, or through condemnation proceedings. They are distinguished from public domain lands in that acquired lands may or may not have been originally owned by the Government. If originally owned by the Government such lands have been disposed of (patented) under the public land laws and thereafter reacquired by the United States.

(j) "Other lands" means (1) "Withdrawn lands." Lands which have been withdrawn and dedicated to public purposes. (2) "Reserved lands." Lands which have been withdrawn from disposal and dedicated to a specific public purpose. (3) "Segregated lands." Lands included in a withdrawal, or in an application or entry or in a proper classification which segregates them from operation of the public land laws.

2. Section 3000.4 of Subpart 3000, Chapter II, Title 43 of the Code of Federal Regulations is revised to read as follows:

§ 3000.4 Appeals.

Any party to a case who is adversely affected by any official action or decision of an officer of the Bureau of Land Management or of an Administrative Law Judge of the Office of Hearings and Appeals, Office of the Secretary, except a decision which has been approved by the Secretary, shall have a right of appeal to the Board of Land Appeals in the Office of Hearings and Appeals, Office of the Secretary. All appeals shall be governed by the rules of practice in Subpart E of Part 4 of this title. Nothing in this group shall be construed to prevent any interested party from seeking judicial review as authorized by law.

3. A new Group 3200 is added to Chapter II, Title 43 of the Code of Federal Regulations to read as follows:

Group 3200—Geothermal Resources Leasing

PART 3200—GEOTHERMAL RESOURCES LEASING; GENERAL

Subpart 3200—Geothermal Resources Leasing; General

Sec.
3200.0–3 Authority.
3200.0–5 Definitions.
3200.0–6 Preleasing procedures.
3200.0–7 Cross reference.
3200.0–8 Use of surface.

Subpart 3201—Available Lands; Limitations; Unit Agreements

Sec.
3201.1 Lands subject to geothermal leasing.
3201.1–1 General.
3201.1–2 Department of the Interior.
3201.1–3 Department of Agriculture.
3201.1–4 Federal Power Commission.
3201.1–5 Patented lands.
3201.1–6 Excepted areas.
3201.2 Acreage limitations.
3201.3 Leases within unit areas.

Subpart 3202—Qualifications of Lessees

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3202.1 Who may hold leases.
3202.2 Statements required to be submitted.
3202.2–1 General.
3202.2–2 Guardian or trustee.
3202.2–3 Attorney-in-fact.
3202.2–4 Statements previously filed.
3202.2–5 Showing as to sole party in interest.
3202.2–6 Heirs and devisees (estates).
3202.2–7 Fractional present interests.

Subpart 3203—Leasing Terms

3203.1 Primary and additional term.
3203.1–1 Dating of leases.
3203.1–2 Primary term.
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3203.1–4 Extensions.
3203.1–5 Segregation of leases on commitment to, or contraction of cooperative or unit plan or communitization agreement.
3203.1–6 Conversion to mineral leases or mining claims.
3203.2 Lease acreage limitation.
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3203.4 Description of lands.
3203.5 Diligent exploration.
3203.6 Plan of operation.

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Circular Distribution List

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3205.1–1 Form of remittance.
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3205.3 Rentals and royalties.
3205.3–1 Payment with application.
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Subpart 3206—Lease Bonds

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3206.1–1 Types of bonds.
3206.1–2 Filing of bonds.
3206.2 Termination of period of liability.
3206.3 Operators bond.
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3206.4–1 Amount.
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3206.4–3 Qualified corporate sureties.
3206.5 Nationwide bond.
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3206.7 Default.
3206.7–1 Payment by surety.
3206.7–2 Penalty.
3206.8 Applicability of provisions to existing bonds.

Subpart 3207—[Reserved]

Subpart 3208—[Reserved]

Subpart 3209—Geothermal Resources Exploration Operations

Sec.
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3209.4–1 General.
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Subpart 3200—Geothermal Resources Leasing; General

§ 3200.0–3 Authority.

These regulations are issued pursuant to the Geothermal Steam Act of 1970 (84 Stat. 1566; 30 U.S.C. 1001–1025) and rights to develop and utilize geothermal resources in land subject to these regulations may be acquired only in accordance with these regulations.

§ 3200.0–5 Definitions.

As used in Group 3200, the term:

(a) "The Act" means the Geothermal Steam Act of 1970.

(b) "Geothermal lease" means a lease issued under authority of the Act; and unless the context indicates otherwise, "lease" means a "geothermal lease".

(c) "Geothermal resources" means geothermal steam and associated geothermal resources which include: (1) All products of geothermal processes, embracing indigenous steam, hot water and hot brines; (2) steam and other gases, hot water and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formations; (3) heat or other associated energy found in geothermal formations; and (4) any byproducts derived from them.

(d) "Byproduct" means (1) any mineral or minerals (exclusive of oil, hydrocarbon gas, and helium) which are found in solution or in association with geothermal steam and which have a value of less than 75 per centum of the value of the geothermal steam or are not, because of quantity, quality, or technical difficulties in extraction and production, of sufficient value to warrant extraction and production by themselves, and (2) commercially demineralized water.

(e) "Sole party in interest" means a party who is and will be vested with all legal and equitable rights under the lease. No one is, or shall be deemed to be, a sole party in interest with respect to a lease in which any other party has any interest in the lease.

(f) "Interest in the lease" means any interest whatever in a geothermal lease, including, but not limited to: A record title interest; a working interest; an operating right; an overriding royalty interest; a claim to any prospective or future advantage or benefit from a lease; a participation in any increment, issue, or profit which may be derived, or accrue in any manner, from the lease based upon, or pursuant to, any agreement or understanding in existence at the time when the offer is filed; and an agreement pertaining to any of the foregoing.

(g) "Supervisor" means a representative of the Secretary, subject to the direction and supervision of the Director, the Chief, Conservation Division, Geological Survey and the appropriate Regional Conservation Manager, Conservation Division, Geological Survey, authorized and empowered to regulate operations and to perform other duties prescribed in the regulations in this part or any subordinate of such representative acting under his direction.

(h) "Primary term" means the first 10 years in the life of the lease, exclusive of any period of suspension of operations or production, or both.

(i) "Area of operation" means that area of the leased lands which is required for exploration, development and producing operations, and which is delineated on a map or plat which is made a part of the approved plan of operations. It encompasses the area generally needed for wells, flow lines, separators, surge tanks, drill pads, mud pits, workshops, and other such faciliites used for on-project geothermal resources field exploration, development and production operations.

(j) "Commercial quantities" means quantities sufficient to provide a return after all variable costs of production have been met.

(k) "Known geothermal resource area" or "KGRA" means an area in which the geology, nearby discoveries, competitive interests, or other indicia would, in the opinion of the Secretary, engender a belief in men who are experienced in the subject matter that the prospects for extraction of geothermal steam or associated geothermal resources are good enough to warrant expenditures of money for that purpose.

(1) In determining whether the geology of an area is of such a nature that the area should be designated a KGRA the Director, Geological Survey, acting for the Secretary, shall use such geologic and technical evidence as he shall deem appropriate, including the following:

(i) The existence of siliceous sinter and natural geysers;

(ii) The temperatures of fumaroles, thermal springs, and mud volcanoes;

(iii) The SiO_2 content of spring water;

(iv) The Na/K ratio in spring waters of hot-water systems;

(v) The existence of volcanoes and calderas of late Teirtary or Quaternary age;

(vi) Conductive heat flows and geothermal gradient;

(vii) The porosity and the permeability of a potential reservoir;

(viii) The results of electrical resistivity surveys;

(ix) The results of magnetic, gravity, and airborne infrared geophysical surveys; and

(x) The information obtained through other geophysical methods such as microseismic, seismic ground noise, electromagnetic, and telluric surveys if such methods prove to have significant use in evaluation.

(2) For purposes of KGRA classification, a "discovery" or "discoveries" will be considered to be any well deemed by the Director, Geological Survey, to be capable of producing geothermal resources in commercial quantities and, where the geological structure is not known, "nearby" will be considered to be five miles or less from any such discovery. Lands nearby a discovery will be classified as KGRA unless the Geological Survey determines that the lands are on a different geologic structure from the discovery. Where the Geological Survey has determined the extent of a structure on which a discovery has been made, all land in that structural area contributing geothermal resources to that discovery will be deemed a KGRA regardless of the distance from the discovery.

(3) "Competitive interest" shall exist in the entire area covered by an application for a geothermal lease if at least one-half of the lands covered by that application are also covered by another application which was filed during the same application filing period, whether or not that other application is subsequently withdrawn or rejected. Competitive interest shall not be deemed to exist in the entire area covered by an application because of an overlapping application, if less than one-half of the lands subject to the first application are covered by any other single application filed

during the same application filing period; however, some of the lands subject to the first application may be determined to be within a KGRA pursuant to the first sentence of this subparagraph (3).

(l) "Primarily valuable" means the principal mineral value for which the leasehold is being produced.

§ 3200.0–6 Preleasing procedures.

(a) When an area is initially considered for geothermal leasing or when the need arises, the Director shall request other interested Bureaus and Federal agencies to prepare reports describing, to the extent known, resources contained within the general area and the potential effect of geothermal resources operations upon the resources of the area and its total environment. If the Director determines that the issuance of leases in an area would be a major Federal action significantly affecting the quality of the human environment, he shall issue no leases in that area unless an environmental impact statement under section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C)) has been issued.

(b) Prior to the final selection of tracts for leasing, the Director, or the head of the agency charged with the administration of the surface, if that officer so elects, shall, when appropriate, evaluate fully the potential effect of the geothermal resources operations pursuant to a leasing program on the total environment, fish and other aquatic resocrces, wildlife habitat and populations, aesthetics, recreation, and other resources in the entire area during exploratory, developmental, and operational phases. This evaluation will consider the potential impact of the possible development and utilization of the geothermal resources including the construction of power generating plants and transmission facilities on lands which may or may not be included in a geothermal lease. To aid him in his evaluation and selection of tracts the Director shall request and consider the views and recommendations of appropriate Federal agencies, may hold public hearings after appropriate notice, and shall, as appropriate, consult with State agencies, organizations, industries, and lease applicants, and shall consider all other potential factors, such as use of the land and its natural resources, the need for the energy mineral deposits, and socio-economic conditions consistent with multiple-use management principles. If a decision is made to lease, the Director shall develop special terms and conditions to be included in leases as required to protect the environment, to permit use of the land for other purposes, and to protect other natural resources. If tracts are offered for competitive leasing, the notice announcing the availability of the land for leasing will specify the proper BLM office where all terms and conditions to be included in leases for such tracts are available.

§ 3200.0–7 Cross reference.

(a) The regulations governing operations under geothermal leases are found in 30 CFR Part 270 .

(b) The regulations setting forth the basic policies for management of the public lands are found in Part 1725 of this chapter.

§ 3200.0–8 Use of surface.

(a) A lessee shall be entitled to use for the production, utilization, and conservation of geothermal resources only so much of the surface of the leased Federal lands as is deemed necessary for such purposes. The lessee shall have the right to use so much of the leased lands as may be deemed necessary for a power generation plant or a commercial or industrial facility, and may apply for the right to use so much of other Federal lands as may be deemed necessary for such purposes; however, any use of the leased lands or other Federal lands for a power generation plant or a commercial or industrial facility will be authorized only under a separate permit issued by the appropriate agency for that specific use and subject to all terms and conditions which it may include in that permit. The uses of the lands within the area of operation are subject to the supervision of the supervisor, and the uses of the remaining leased lands or other Federal lands are subject to the supervision of the appropriate surface management agency. The lessee shall not be entitled to use any mineral materials subject to the Materials Act except as provided by Part 3600 of this chapter.

(b) Operations under other leases or uses on the same lands shall not unreasonably interfere with or endanger operations under leases issued under these regulations nor shall operations under these regulations unreasonably interfere with or endanger operations under any lease, license, claim, permit, or other authorized use pursuant to the provisions of any other Act.

Subpart 3201—Available Lands; Limitations, Unit Agreements

§ 3201.1 Lands subject to geothermal leasing.

§ 3201.1–1 General.

Subject to the exceptions listed below, geothermal leases may be issued in combination or separately for (a) lands administered by the Secretary of the Interior; (b) national forest lands or other lands administered by the Department of Agriculture through the Forest Service; and (c) geothermal resources in lands which have been conveyed by the United States subject to a reservation to the United States of geothermal resources.

§ 3201.1–2 Department of the Interior.

(a) Except as provided in this section, leases may be issued in accordance with the regulations in this part for withdrawn lands, for acquired lands, and for geothermal resources in lands which have passed from Federal ownership subject to a reservation to the United States of the geothermal resources therein where such lands or resources are administered by the Secretary of the Interior.

(b) Notwithstanding any other provision in these regulations, geothermal leases shall not be issued for: (1) Lands which the Secretary has identified or may identify as being necessary to the performance of his or any other Federal officer's authorized functions, and on which geothermal resource development would in his judgment interfere with such functions; or (2) lands respecting which the Secretary has made or may make a finding that the issuance of geothermal leases would be contrary to the public interest. Upon receipt of an application for a geothermal lease affecting lands withdrawn under section 3 of the Reclamation Act of 1902 (43 U.S.C. 416) or any other appropriate authority, notice thereof and an opportunity to comment thereon shall be given to the head of the agency for whose benefit the withdrawal was made. No geothermal lease affecting lands withdrawn for any agency outside the Department of the Interior shall be leased without the consent of the head of the agency for which the lands are withdrawn. Where leases are issued under Part 3210 of this chapter or 3220 for lands neighboring such reserved lands, the lessees shall be required to perform such lease operations and take such measures as are prescribed by the Secretary for the protection of the Federal interests therein.

§ 3201.1–3 Department of Agriculture.

Leases for public, withdrawn or acquired lands administered by the Forest Service, may be issued by the Secretary of the Interior only with the consent of, and subject to such terms and conditions as may be prescribed by, the head of that Department to insure adequate utilization of the lands for the purpose for which they were withdrawn or acquired.

§ 3201.1–4 Federal Power Commission.

Leases for lands to which section 24 of the Federal Power Act, as amended (16 U.S.C. 818), is applicable, may be issued by the Secretary of the Interior only with the consent of, and subject to, such terms and conditions as the Federal Power Commission may prescribe to insure adequate utilization of such lands for power and related purposes.

§ 3201.1–5 Patented lands.

(a) Geothermal resources in lands which have passed from Federal ownership subject to a reservation to the United States of geothermal resources therein may be leased under the regulations in this group subject to the provisions in this part and to such terms and conditions as may be prescribed by the authorized officer to insure adequate protection of the patented lands and any improvements thereon.

(b) Geothermal resources in lands the surface of which has passed from Federal ownership but in which the minerals have been reserved to the United States shall not be developed or produced except under terms and conditions prescribed by the Secretary and pursuant to any agreements made therefor while the question of the title to such resources is being resolved pursuant to the provisions of section 21(b) of the Act.

§ 3201.1–6 Excepted areas.

Leases shall not be issued for lands which are: (a) Administered under the

National Park System; (b) within a national recreation area; (c) in a fish hatchery administered by the Secretary, wildlife refuge, wildlife range, game range, wildlife management area, or waterfowl production area, or for lands acquired or reserved for the protection and conservation of fish and wildlife which are designated as rare and endangered species by the Secretary; or under active consideration for inclusion in categories (a), (b), or (c) as evidenced by the filing of an application for a withdrawal or a proposed withdrawal; or (d) tribally or individually owned Indian trust or restricted lands, within or without the boundaries of Indian reservations.

§ 3201.2 Acreage limitations.

(a) *Maximum holdings.* No citizen, association, corporation, or governmental unit shall take, hold, own, or control at one time, whether acquired directly from the Secretary or otherwise, any direct or indirect interest in Federal geothermal leases in any one State exceeding 20,480 acres, including leases acquired under the provisions of section 4 (a)–(f) of the Act. Nor may any citizen, association, or corporation be permitted to convert mineral leases, permits, applications therefor, or mining claims, pursuant to the provisions of section 4 (a)–(f) of the Act into geothermal leases for more than 10,240 acres.

(b) *Computation.* In computing acreage holdings or control, the accountable acreage of a party owning an undivided interest in a lease shall be that party's proportionate part of the total lease acreage. Likewise, the accountable acreage of a party owning an interest in a corporation or association shall be his proportionate part of the corporation's or association's accountable acreage except that no person shall be charged with his pro rata share of any acreage holdings of any association or corporation unless he is the beneficial owner of more than 10 per centum of the stock or other instruments of ownership or control of that association or corporation. Parties owning a royalty or other interest determined by or payable out of a percentage of production from a lease will be charged with a similar percentage of the total lease acreage.

(1) An association shall not be deemed to exist between the parties to a contract for development of leased lands, whether or not coupled with an interest in the lease, nor between co-lessees, but each party to any such contract or each colessee will be charged with his proportionate interest in the lease.

(2) Lessees holding acreage in common shall be considered a single entity and cannot hold acreage in excess of the maximum specified in the law for any one lessee.

(c) *Excepted acreage.* Leases committed to any unit or cooperative plan approved or prescribed by the Secretary of the Interior shall not be included in computing accountable acreage. Leases subject to an operating, drilling or development contract approved by the Secretary pursuant to section 18 of the Act, other than communization or drilling agreements, shall be excepted in determining the accountable acreage of the lessees or operators.

(d) *Excess acreage.* (1) Where, as the result of the termination or contraction of a unit or cooperative plan, or the elimination of a lease from operating, drilling, or development plan, a party holds or controls excess accountable acreage, such party shall have 90 days from such termination or contraction or elimination in which to reduce his holdings to the prescribed limitation.

(2) If any person holding or controlling leases or interests in leases is found to hold accountable acreage in violation of the provisions of this section and of the Act, the last lease or leases or interest or interests acquired by him which created the excess acreage holdings shall be canceled or forfeited in their entirety, even though only part of the acreage in the lease or interest constitutes excess holdings, unless it can be shown to the satisfaction of the Director that the holding or control of the excess acreage is not the result of negligence or willful intent in which event the lease or leases shall be canceled only to the extent of the excess acreage.

(3) Any person holding or controlling leases or interests in leases below the acreage limitation provided in this section, shall be subject to these rules:

(i) If he files an application which causes him to exceed the acreage limitation, that application will be rejected.
(ii) If he files a group of applications at the same time, any one of which causes him to exceed the acreage limitation, the entire group of applications will be rejected.

(4) If any person holding or controlling leases or interests in leases below the acreage limitation provided in this section, acquires a lease or leases, or an interest or interests therein, which cause him to exceed the acreage limitation, his most recently filed application for lease or applications for leases then containing acreage in excess of the limitation provided in this section will be rejected in its or their entirety. For the purpose of this subparagraph, time of filing shall be determined by the date of filing marked on the application, or, if the same date is marked on two or more applications, by the serial number of the applications.

(e) *Showing required.* No lease will be issued and no transfer or operating agreement will be approved until it has been shown that the applicant, operator, or transferee is entitled to hold the acreage or obtain the operating rights. At any time upon request by the authorized officer, the record title holder of any lease or a lease operator or a lease applicant may be required to file in the proper BLM office a statement, showing as of a specified date the serial number and the date of each lease of which he is the record holder, or under which he holds operating rights, and each application for lease held or filed by him in the particular State setting forth the acreage covered thereby, and the nature, extent and acreage interest, including royalty interests held by him in any geothermal lease of which the reporting party is not the lessee of record, whether by corporate stock ownership, interest in unincorporated associations and partnerships, or in any other manner.

§ 3201.3 Leases within unit areas.

Before issuance of a geothermal lease for lands within an approved unit agreement, the lease applicant or successful bidder will be required to file evidence that he has entered into an agreement with the unit operator for the development and operation of the lands in a lease if issued to him under and pursuant to the terms and provisions of the approved unit agreement, or a statement giving satisfactory reasons for the failure to enter into such agreement. If such statement is acceptable, he will be permitted to operate independently but will be required to perform his operations in a manner which the Supervisor deems to be consistent with the unit operations.

Subpart 3202—Qualifications of Lessees

§ 3202.1 Who may hold leases.

Leases may be issued only to: (a) Citizens of the United States who have reached the age of majority; (b) associations of such citizens; (c) corporations organized under the laws of the United States, any state or the District of Columbia; or (d) governmental units, including, without limitation, municipalities. The term "association" includes a partnership.

§ 3202.2 Statements required to be submitted.

§ 3202.2–1 General.

(a) Each applicant for a lease is required to submit with his application a statement that his interests, direct and indirect, in Federal geothermal leases do not exceed the acreage limitations prescribed in § 3201.2, together with a statement of his citizenship.

(b) If the applicant is an association or corporation the application must be accompanied by: (1) A statement showing that it is authorized to hold geothermal leases; (2) a statement that the officer executing the application is authorized to act on behalf of the association or corporation; (3) a statement setting forth the State in which it was incorporated or formed and the names and addresses of all members or stockholders holding more than 10 percent of the association or corporation; and (4) a statement from each person owning or controlling more than 10 percent of the association or corporation setting forth his citizenship and his holdings.

(c) If the applicant is a municipality, or governmental unit, the application must be accompanied by: (1) A statement showing that it is authorized to hold geothermal leases; (2) a statement that the officer executing the application is authorized to act on behalf of the municipality or governmental unit, and (3) a copy of its governing body's resolution authorizing such action.

§ 3202.2–2 Guardian or trustee.

(a) *Guardian.* If the application is made by a guardian, he must submit: (1) A certified copy of the court order authorizing him to act as guardian and, in behalf of his ward, to enter into contractual agreements and to fulfill all obligations arising under the lease; and (2) statements as to the citizenship and holdings under the Act of himself and of each person under his guardianship for whom the application is made.

(b) *Trustee.* If the application is made by a trustee, he must submit a copy of the instrument establishing the trust or a certified copy of the court order authorizing him to act as trustee, in behalf of the beneficiary, as to all obligations arising under the lease; and statements as to the citizenship and holdings under the Act of himself and of each beneficiary.

§ 3202.2–3 Attorney-in-fact.

If an application is filed by an attorney-in-fact, it must be accompanied by a statement as to his authority to act.

§ 3202.2–4 Statements previously filed.

Where the statements required by § 3202.2 have been previously filed a reference by serial number to the record in which they have been filed, together with a statement as to any amendments will be accepted.

§ 3202.2–5 Showing as to sole party in interest.

Each application must indicate whether the applicant is the sole party in interest. Where the applicant is not the sole party in interest, separate statements must be signed by each of the parties and by the applicant setting forth the nature of the agreement between them. All interested parties must furnish evidence of their qualifications to hold such lease interest. These separate statements must be filed in the proper BLM office with the application, except as provided in § 3211.2 of this chapter.

§ 3202.2–6 Heirs and devisees (estates).

If an applicant or a successful bidder dies before the lease is issued, the lease will be issued to the executor or administrator of the estate if probate of the estate has not been completed, and if probate has been completed, or is not required, to the heirs or devisees, provided there is filed in all cases an application to lease in compliance with the requirements of this section which will be effective as of the effective date of the original application filed by the deceased. If there are any minor heirs or devisees, the application can only be made by their legal guardian or trustee in his name. Each such application must be accompanied by the following information:

(a) Where probate of the estate has not been completed:

(1) Evidence that the person who as executor or administrator submits the application, and bond form if a bond is required, has authority to act in that capacity and to sign the application and bond forms.

(2) A statement over the signature of each heir or devisee or, if the heir or devisee is a minor, over the signature of his legal guardian or trustee, concerning citizenship and holdings.

(3) Evidence that the heirs or devisees are the heirs or devisees of the deceased applicant or successful bidder and are the only heirs or devisees of the deceased.

(b) Where the executor or administrator has been discharged or no probate proceedings are required:

(1) A certified copy of the will or decree of distribution, if any, and if not, a statement signed by the heirs that they are the only heirs of the applicant or successful bidder and the provisions of the law of the deceased's last domicile showing that no probate is required.

(2) A statement over the signature of each of the heirs or devisees with reference to holdings and citizenship. If the heir or devisee is a minor, the statement must be over the signature of the guardian or trustee.

§ 3202.2–7 Fractional present interests.

(a) An application for a fractional present interest noncompetitive lease must be executed on a form approved by the Director and it must be accompanied by a statement showing the extent of the applicant's ownership of the operating rights to the fractional geothermal resources interest not owned by the United States in each tract covered by the application to lease. Ordinarily, the issuance of a lease to one who, upon such issuance, would own less than 50 percent of the operating rights in any such tract, will not be regarded as in the public interest, and an application leading to such results will be rejected.

(b) Geothermal resources in lands which have passed from Federal ownership but which lands have been purchased by the Federal Government with a fractional interest in the geothermal resources shall not be developed or produced, except under prescribed terms and conditions and pursuant to any agreement made between the parties of interest prior to the resolution of the question of ownership of the geothermal resources.

Subpart 3203—Leasing Terms

§ 3203.1 Primary and additional term.

§ 3203.1–1 Dating of leases.

All geothermal leases will be dated as of the first day of the month following the date on which the leases are signed on behalf of the lessor except that, where prior written request has been made, a lease may be dated as of the first day of the month within which it is so signed. A renewal lease will be dated from the termination of the original lease.

§ 3203.1–2 Primary term.

All leases shall be for a primary term of 10 years.

§ 3203.1–3 Additional term.

(a) If geothermal steam is produced or utilized in commercial quantities within the primary term of a lease, that lease shall continue for so long thereafter as geothermal steam is produced or utilized in commercial quantities, but the lease shall in no event continue for more than 40 years after the end of the primary term except that the lessee shall have a preferential right to a renewal of his lease for a second 40-year term upon such terms and conditions as the authorized officer deems appropriate, if at the end of the first 40-year term the lands are not needed for another purpose and geothermal steam is produced or utilized in commercial quantities. Production or utilization of geothermal steam in commercial quantites shall be deemed to include the completion of one or more wells producing or capable of producing geothermal steam in commercial quantities and a bona fide sale of such geothermal steam for delivery to or utilization by a facility or facilities not yet installed but scheduled for installation not later than 15 years from the date of commencement of the primary term of the lease.

§ 3203.1–4 Extensions.

(a) A lease which has been extended by reason of production, or on which geothermal steam has been produced, and which has been determined by the Secretary to be incapable of further commercial production and utilization of geothermal steam may be further extended so long as one or more valuable byproducts are produced in commercial quantities but for not more than 5 years.

(b) Where the lessee commenced actual drilling operations prior to the end of the primary term and those operations are being diligently prosecuted at that time, a lease shall be extended for a period of five years and so long thereafter as geothermal steam is produced or utilized in commercial quantities (but for not more than 35 years).

(c) A lease committed to a cooperative plan, communitization agreement or a unit plan under or for which actual drilling operations were commenced prior to the end of the primary term of the lease, shall, if such operations are being diligently prosecuted at that time be extended for a period of five years and so long thereafter as geothermal steam is produced or utilized in commercial quantities (but for not more than thirty five years).

(d) Any lease on which there has been a suspension of operations or production, or both, under 30 CFR 270.17 shall continue in effect for the life of the suspension and, at the end of the suspension, shall be extended for a period equal to that portion of the primary term during which the suspension was in effect.

(e) If, at the end of 40 years after the conclusion of the primary term, steam is being produced or utilized in commercial quantities and the lands are not needed for other purposes, the lessee shall have a preferential right to a renewal of the lease for a second 40-year term on such terms and conditions as the Secretary deems appropriate.

§ 3203.1–5 Segregation of leases on commitment to, or contraction of, cooperative or unit plan or communitization or drilling agreement.

(a) Any lease committed to any cooperative plan, communitization agreement, drilling agreement, or unit plan, which covers lands within and lands outside the area covered by the plan or agreement, shall be segregated, as of the effective date of that plan or agreement, into separate leases, one covering the lands committed to that plan or agreement and the other as to the lands not so committed. The segregated lease covering the portion of the lands not subject to that plan or agreement shall not be entitled to an extension by reason of the segregation, but the term of the lease of such segregated lands shall be as provided in the original lease.

(b) When only part of the land subject to a lease included in a cooperative plan, a communitization agreement, a drilling agreement, or a unit plan is excluded from that plan or agreement because of the contraction of the area subject to that plan or agreement, the part of the lease which is excluded and the part which remains subject to the plan or agreement shall be segregated into separate leases. The term of the segregated lease composed of the excluded land shall not be extended because of production in commercial quantities or the existence of a producible well on the segregated lease remaining subject to the cooperative or unit plan or the communitization or drilling agreement or because actual drilling operations were at the time of contraction being conducted on that other lease, but the term of the lease composed of the excluded land shall be as provided in the original lease.

(c) Where all the land subject to a lease included in a cooperative plan, a communitization agreement, a drilling agreement, or a unit plan is excluded from that plan or agreement because of the contraction of the area subject to that plan or agreement, the term of the lease shall not be extended because of production in commercial quantities or the existence of a producible well on the lands remaining subject to the cooperative or unit plan or the communitization or drilling agreement or because actual drilling operations were being conducted on the other lands, but the term of the lease shall be as provided in the original lease.

(d) Contraction of a unit or cooperative plan or a communitization or drilling agreement causing all or part of the land in the lease to be excluded from such plan or agreement shall not serve to extend the term of such lease excluded by reason of the contraction where the 10-year primary term has already expired.

§ 3203.1–6 Conversion to mineral leases or mining claims.

(a) If the byproducts capable of being produced in commercial quantities are leasable under the Mineral Leasing Act of February 25, 1920 as amended and supplemented (30 U.S.C. sections 181–287), or under the Mineral Leasing Act for Acquired Lands (30 U.S.C. sections 351–359), and the leasehold is primarily valuable for the production thereof, the lessee shall be entitled to convert his geothermal lease to a mineral lease under and subject to all the terms and conditions of the appropriate act, provided the lands and its resources are available for this purpose, upon application at any time before expiration of the lease extension by reason of byproduct production.

(b) The lessee shall be entitled to locate under the mining laws all minerals which are not leasable and which would constitute a byproduct if commercial production or utilization of geothermal steam continued. The lessee, to acquire the rights herein granted him, shall complete the location of mining claims within 90 days after the termination of the geothermal lease, provided the lands and its resources are available for location.

(c) Any lease converted under paragraphs (a) or (b) of this section affecting lands withdrawn or acquired in aid of a function of a Federal department or agency, including the Department of the Interior, shall be subject to such additional terms and conditions as may be prescribed by that department or agency with respect to the additional operations or effects resulting from such conversion upon the utilization of the lands for the purpose for which they are administered.

§ 3203.2 Lease acreage limitation.

(a) A geothermal lease may not embrace more than 2,560 acres in a reasonably compact area, except where a departure is occasioned by an irregular subdivision or subdivisions, entirely within an area of six miles square or within an area not exceeding six surveyed or protracted sections in length or width measured in cardinal directions. Where a departure is occasioned by an irregular subdivision, the leased acreage may exceed 2,560 acres by an amount which is smaller than the amount by which the area would be less than 2,560 acres if the irregular subdivision were excluded. No lease will be issued for less than 640 acres, except at the discretion of the Secretary, or where a departure is occasioned by an irregular subdivision, or as provided for in Subpart 3230 of this chapter. In event of a departure, the leased acreage may be less than 640 acres by amount which is smaller than the amount by which the area would be more than 640 acres if the irregular subdivision were added.

(b) The authorized officer may add isolated tracts in nearby sections, notwithstanding the 640-acre minimum, where it is determined that such addition is necessary for the proper management of the resource, provided the additional lands will not cause the lessee to exceed the maximum acreage limitation as provided in § 3201.2(a) of this chapter. However, prior to the issuance of such a lease based on the application as amended by the authorized officer, the applicant will be given the option to refuse such a lease. Failure of the applicant to execute and return the lease within 30 days after receipt thereof will constitute a withdrawal of his application, as amended, without further notice.

§ 3203.3 Consolidation of leases.

Two or more contiguous leases issued to the same lessee may be consolidated if the total combined acreage does not exceed 2,560 acres. Except where a deacreage is caused by an irregular subdivision or subdivisions as stated in § 3203.2.

§ 3203.4 Description of lands.

Applications and nominations shall include a description of the lands sought to be included in a geothermal lease.

(a) *Surveyed lands.* If the lands have been surveyed under the public land rectangular system, each application or nomination shall describe the lands by legal subdivision, section, township, and range.

(b) *Unsurveyed lands.* If the lands have not been so surveyed, each application shall describe the lands by metes and bounds, giving courses and distances between the successive angle points on the boundary of the tract, in cardinal directions except where the boundaries of the lands are in irregular form, and connected by courses and distances to an official corner of the public land surveys or to a prominent topographic feature. In Alaska the description of unsurveyed lands must be connected by courses and distances to either an official corner of the public land surveys or to a triangulation station established by any agency of the United States (such as the U.S. Geological Survey, the Coast and Geodetic Survey, or the International Boundary Commission), if the record position thereof is available to the general public.

(c) When protracted surveys have been approved and the effective date thereof published in the FEDERAL REGISTER, each application or nomination for lands shown on such protracted surveys, filed on or after such effective date, shall describe the lands according to the legal subdivision, section, township, and range shown on the approved protracted surveys.

(d) *Unsurveyed public lands adjacent to tidal waters in southern Louisiana and in Alaska.* In lease applications embracing unsurveyed public lands adjacent to tidal waters in southern Louisiana and in Alaska, if the applicant finds it impracticable to furnish a metes and bounds description, as required in paragraph (b) of this section with respect to the water boundary, he may, at his option, extend the boundary of his application into the water a distance sufficient to permit complete enclosure of the water boundary of his application by a series of courses and distances in cardinal directions (the object being to eliminate the necessity of describing the meanders of the water boundary of the public lands included in the application). The description in the lease application shall in all other respects conform to the requirements of paragraph (b) of this section. Such description would not be deemed for any purpose to describe the true water boundaries of the lease, such boundaries in all cases being the ordinary high water mark of the navigable waters. The land boundaries of such overall area shall include only the public lands embraced in the application. The applicant shall agree to pay rental on the full acreage included within the description with the understanding that rights under any lease to be issued on that application will apply only to the areas within that description properly subject to lease under the act, but that the total area described will be considered as the lease acreage for purposes of rental payments, acreage limitations under § 3201.2 of this chapter and the maximum or minimum area to be included in a lease pursuant to § 3203.2. The tract should be shown in outline on a current quadrangle sheet published by the U.S. Geological Survey or such other map as will adequately identify the lands described.

§ 3203.5 Diligent exploration.

Each geothermal lease will include provisions for the diligent exploration of the leased resources until there is production in commercial quantities applicable to the lands subject to the lease, and failure to perform such exploration may subject the lease to termination. Diligent exploration means exploration operations (subsequent to the issuance of the lease) on, or related to the leased lands, including, but not limited to, operations such as geochemical surveys, heat flow measurements, core drilling, or drilling of a test well. Exploration operations, in order to qualify as diligent exploration, must be approved by the Supervisor, and evidence of all expenditures therefor and the results thereof must be submitted annually to the Supervisor in compliance with applicable regulations and Geothermal Resources Operational (GRO) Orders or upon his request. Moreover, after the fifth year of the primary lease term, exploration operations, to qualify as diligent exploration for a year, must entail expenditures during that year equal to at least two times the sum of (a) the minimum annual rental required by statute, and (b) the amount of rental for that year in excess of the fifth year's rental, but in no event shall the required expenditures exceed twice the rental for the 10th year. However, any expenditures for diligent operations during the first 5 years of the lease and any expenditures for diligent operations during any subsequent year in excess of the minimum required expenditures for that year may be credited, in such proportions as the lessee may designate, against (1) expenditures needed to qualify exploration operations as diligent operations for future years, or (2) any rental requirement for that or any future years in excess of the fifth year's rental pursuant to § 3205.3–3 of this chapter. In all cases, the lessee must pay the basic annual rental specified in the lease for the initial five years of the primary term until there is production of geothermal steam in commercial quantities on the leased lands.

§ 3203.6 Plan of operation.

A lessee will be required to submit a plan of operation pursuant to 30 CFR 270.34, prior to entry upon the leased lands for any purpose other than casual use as that term is defined in § 3209.0–5 (d) of this chapter. Operations will not be permitted on the lands until the plan of operation has been approved.

Subpart 3204—Surface Management Requirements, Special Requirements

§ 3204.1 General.

A lessee shall comply with and be bound by the following general terms and conditions, the specific requirements contained in the lease stipulations and any GRO orders that may be issued pursuant to 30 CFR 270.11. Assuring compliance with the requirements of this section is the responsibility of the Supervisor as to the lands within the area of operations and is the responsibility of the appropriate land management agency as to the remaining lands in the lease.

(a) *Equal employment opportunity.* The lessee shall comply with Executive Order 11246, as amended, 30 F.R. 12319 (1965), and regulations issued pursuant thereto, 41 CFR Chapter 60 and 43 CFR Part 17.

(b) *Public access.* (1) The lessee shall permit free and unrestricted public access to and upon the leased lands for all lawful and proper purposes except in areas where such access would unduly interfere with operations under the lease or would constitute a hazard to health and safety. Restrictions on access will not be allowed without prior approval.

(2) During construction, the lessee shall regulate public access and vehicular traffic to protect the public, wildlife, and livestock from hazards associated with the project. For this purpose, the lessee shall provide warnings, fencing, flag men, barricades, and other safety measures as appropriate.

(c) *Pollution abatement.* The lessee shall comply with all Federal and State standards and all applicable local standards with respect to the control of all forms of air, land, water, and noise pollution, including, but not limited to, the control of erosion and the disposal of liquid, solid, and gaseous wastes. The Supervisor may, in his discretion, establish additional and more stringent standards, and, if he does so, the lessee shall comply with those standards. The lessee, in addition to any other action required by those standards, shall take the following specific actions:

(1) *Pesticides and herbicides.* The lessee shall comply with all rules issued by the Department of the Interior and the Environmental Protection Agency pertaining to the use of poisonous substances on public lands.

(2) *Water pollution.* The lessee shall conduct lease operations and maintenance in accordance with Federal and State water quality standards and public health and safety standards, and applicable local water quality standards and public health and safety standards. Toxic materials shall not be released into any surface waters or underground waters. Reinjection of waste geothermal fluids into geothermal or other suitable aquifers will be permitted upon approval of the lessee's plan of operation submitted pursuant to 30 CFR 270.34.

(3) *Air pollution.* The lessee shall control emissions from operations in accordance with Federal and State air quality standards, and applicable local air quality standards.

(4) *Erosion control.* The lessee shall minimize disturbance to vegetation, drainage channels, and streambanks. The lessee shall employ such soil and resource conservation and protection measures on the leased lands as the Supervisor deems necessary.

(5) *Noise control.* The lessee shall control noise emissions from operations. in accordance with Federal and State noise emission standards, and applicable local noise emission standards.

(d) *Sanitation and waste disposal.* The lessee shall remove or dispose of all waste material generated in connection with the exploration, development, production and transportation operations in a manner set forth in the approved plan of operation submitted pursuant to 30 CFR 270.34.

(e) *Land subsidence, seismic activity.* The lessee shall take precautions necessary to minimize land subsidence or seismic activity which could result from production of geothermal resources and the disposal of waste fluid where such activity could damage or curtail the use of the geothermal resources or other resources, or other uses of the land and take such measures as stipulated to: (1) monitor operations for land subsidence and for seismic activity; and (2) maintain, and when requested, make available to the lessor, records of all monitoring activities.

(f) *Aesthetics.* The lessee shall take aesthetics into account in the planning, design, and construction of facilities on the leased premises.

(g) *Fish and wildlife.* The lessee shall employ such measures as are deemed necessary to protect fish and wildlife and their habitat.

(h) *Antiquities and historical sites.* The lessee shall conduct activities on discovered, known or suspected archeological, paleontological, or historical sites in accordance with lease terms or specific instructions.

(i) *Restoration.* The lessee shall provide for the restoration of all disturbed lands in an approved manner.

(j) The lessee shall submit annual reports to the authorized officer on compliance with the requirements of paragraphs (b)–(i) of this setcion and report within 24 hours, and if the report is oral, shall confirm the report in writing within 30 days, any significant environmental damage suffered by the lands subject to his lease. However, if, after drilling operations have begun, the lessee is required to submit a similar report under 30 CFR 270.30 and 270.76, he may fulfill the requirement of this subsection by submitting to the authorized officer a copy of that report.

§ 3204.2 Waste prevention.

All leases shall be subject to the condition that the lessee will, in conducting his exploration, development. and producing operations, use all reasonable precautions to prevent waste of geothermal resources and other natural resources found or developed in the leased lands.

§ 3204.3 Readjustment of terms and conditions.

(a) (1) Except as otherwise provided by law, the terms and conditions of any geothermal lease may be readjusted as determined by the authorized officer at not less than 10-year intervals beginning 10 years after the date geothermal steam is produced. Each lease shall provide for such readjustments.

(2) The authorized officer shall give notice to the lessee of any proposed readjustment of the terms and conditions of the lease and the nature thereof, and unless the lessee files with the authorized officer an objection to the proposed terms and conditions or relinquishes the lease within 30 days after receipt of such notice, the lessee shall be deemed conclusively to have agreed to such terms and conditions. If the lessee files objections, and agreement cannot be reached between the authorized officer and the lessee within a period of 60 days, the lease may be terminated by either party, subject to the provisions of § 3000.4 of this chapter. If the lessee files objections to

the proposed readjusted terms and conditions, the existing terms and conditions, except for those concerning rental and royalty rates, will remain in effect until there has been an agreement between the authorized officer and the lessee on the new terms and conditions to be applied to the lease or until the lease is terminated. The readjustment of any terms concerning rental and royalty rates will be subject to § 3205.3 of this chapter.

(b) Any readjustment of the terms and conditions of any lease of lands withdrawn or acquired in aid of a function of a Federal department or agency may be made only with the approval of that other agency.

§ 3204.4 Reservation to the United States of oil, hydrocarbon gas, and helium.

The United States reserves the ownership of and the right to extract oil, hydrocarbon gas, and helium from all geothermal steam and associated geothermal resources produced from lands leased under the Act. Whenever the right to extract oil, hydrocarbon gas, and helium, from geothermal steam and associated geothermal resources produced from such lands is exercised, it shall be exercised so as to cause no substantial interference with the production of geothermal resources from such lands.

§ 3204.5 Compensation for drainage; compensatory royalty.

(a) Upon a determination by the Supervisor that lands owned by the United States are being drained of geothermal resources by wells drilled on adjacent or cornering lands, the authorized officer may execute agreements with the owners of adjacent or cornering lands whereby the United States, or the United States and its lessees, shall be compensated for such drainage, such agreements to be made with the consent of any lessee affected thereby. The precise nature of any agreement will depend on the conditions and circumstances involved in the particular case.

(b) Where land in any lease is being drained of its geothermal resources by a well either on a Federal lease issued at a lower rate of royalty or on land not the property of the United States, the lessee must drill and produce all wells necessary to protect the leased lands from drainage. In lieu of drilling such wells, the lessee may, with the consent of the Supervisor, pay compensatory royalty in the amount determined in accordance with 30 CFR Part 270.

§ 3204.6 Patented lands.

The terms and conditions of any geothermal resource lease for lands conveyed by the United States subject to a reservation to the United States of geothermal resources may be readjusted upon notification to the surface owner.

Subpart 3205—Service Charges, Rentals and Royalties

§ 3205.1 Payments.

§ 3205.1–1 Form of remittance.

Remittances required under these regulations may be made by cash payment, check, certified check, bank draft, bank cashier's check, or money order. All remittances will be deposited as received.

§ 3205.1–2 Where submitted.

(a) *Rentals on nonproducing leases.* Rentals under all nonproducing leases issued shall be paid at the proper BLM office. All remittances to the Bureau of Land Management shall be made payable to the Bureau of Land Management.

(b) *Other payments.* All royalties on producing leases, communitized leases in producing well units, unitized leases in producing unit areas, leases on which compensatory royalty is payable and all royalty payments under easements for directional drilling are to be paid to the Supervisor. All remittances to the Supervisor shall be made payable to the U.S. Geological Survey.

§ 3205.2 Service charges.

(a) *Competitive lease applications.* No service charge is required.

(b) *Noncompetitive lease applications.* Applications for noncompetitive leases must be accompanied by a nonrefundable service charge of $50 for each application.

(c) *Assignments.* Applications for approval of an assignment of a lease or interest therein must be accompanied by a nonrefundable service charge of $50 for each application.

(d) *Nominations.* No service charge is required.

§ 3205.3 Rentals and royalties.

§ 3205.3–1 Payment with application.

Each application, except an application filed pursuant to Subpart 3211 of this chapter, of this part, must be accompanied by payment of the first year's rental of $1 per acre or fraction thereof based on the total acreage included in the application. An application accompanied by a payment of the first year's rental which is deficient by not more than 10 percent will be approved by the authorized officer provided all other requirements are met, but, if the additional rental is not paid within 30 days from notice, the application or the lease, if issued, will be canceled. If the annual rental rate established for the lease to be issued is more than $1 per acre or required to submit the additional rental fraction thereof, the applicant will be prior to issuance of the lease upon notice from the authorized officer.

§ 3205.3–2 Payment of annual rental.

(a) Annual rental in the amount specified in the lease which shall be not less than $1 per acre or fraction thereof must be paid in advance and must be received by the proper BLM office on or before the anniversary date of the lease. If there is no well on the leased lands capable of producing geothermal resources in commercial quantities, the failure to pay rental on or before the anniversary date shall terminate the lease by operation of law, except as provided by § 3244.2 of this chapter.

(b) If, on the anniversary date of the lease, less than a full year remains in the lease term, the rentals shall be payable in the same proportion as the period remaining in the lease term is to a full year. The rentals shall be prorated on a monthly basis for the full months, and on a daily basis for the fractional month remaining in the lease term. For the purpose of prorating rentals for a fractional month, each month will be deemed to consist of 30 days.

(c) If the term of a lease for which prorated rentals have been paid is further extended to or beyond the next anniversary date of the lease, rentals for the balance of the lease year shall be due and payable on the 1st day of the first month following the date through which the prorated rentals were paid. If the rentals are not paid for the balance of the lease year, the lease will be subject to cancellation. However, if the anniversary date occurs before the end of the notice period, the rental for the following lease year shall nevertheless be due on the anniversary date and failure to pay the full rental for that year on or before that date shall cause the lease to terminate automatically by operation of law except as provided by § 3244.2 of this chapter. The lessee shall not be relieved of liability for rental due for the balance of the previous lease year.

(d) If the payment is due on a day in which the proper BLM office to receive payment is not open, payment received on the next official working day will be deemed to be timely.

§ 3205.3–3 Escalating rental rates.

To encourage the orderly and timely development of geothermal leases, all leases issued pursuant to the regulations in this Group will provide that, beginning with the sixth year and for each year thereafter until the lease year beginning on or after the commencement of production of geothermal resources in commercial quantities, the rental will be set by the authorized officer as the amount of rental for the preceding year plus an additional rental of $1 per acre, or fraction thereof, but the authorized officer may, upon a showing of sufficient justification by the lessee, waive the payment of all or any portion of the additional rental.

§ 3205.3–4 Fractional interests.

Rentals, minimum royalties, and royalties payable for lands in which the United States owns an undivided fractional interest shall be in the same proportion to the rentals, minimum royalties, and royalties provided for in § 3205.3, as the undivided fractional interest of the United States in the geothermal resources is to the full geothermal resources interest.

§ 3205.3–5 Royalty on production.

Royalty shall be paid at the following rates on geothermal resources:

(a) A rate, as set forth in the lease, of not less than 10 per centum and not more than 15 per centum of the amount or value of steam, or any other form of heat or energy derived from production under the lease and sold or utilized by the lessee or reasonably susceptible to sale or utilization by the lessee; (b) a rate as set forth in the lease, of not more than 5 per centum of any byproduct derived from production under the lease and sold or utilized or reasonably susceptible of sale or utilization by the lessee, except that as to any byproduct which is a mineral named in section 1 of the Mineral Leasing Act of February 25, 1920, as amended (30 U.S.C. 181), the rate of royalty for such mineral shall be the same as that provided in that Act and the maximum rate of royalty for such mineral shall not exceed the maximum royalty applicable under that Act; (c) in no event shall the royalty on any producing lease for any lease year, commencing with the lease year beginning on or after the commencement of production in commercial quantities, be less than $2 per acre or fraction thereof, and this minimum royalty, in lieu of rental, shall be payable at the expiration of each lease year.

§ 3205.3–6 Royalty on commercially demineralized water.

All geothermal leases issued pursuant to the provisions of this group shall provide for the payment to the lessor of a royalty on commercially demineralized water at a rate to be specified in the lease of not more than 5 per centum of the value of such commercially demineralized water that has beeen sold or utilized by the lessee or is reasonably susceptible of sale or utilization by the lessee, except that no payment of a royalty will be required on such water if it is used in plant operation for cooling or in the generation of electric energy or otherwise.

§ 3205.3–7 Waiver, suspension or reduction of rental or royalty.

(a) The authorized officer may waive, suspend, or reduce the rental or royalty for any lease or portion thereof in the interests of conservation and to encourage the greatest ultimate recovery of geothermal resources if he determines that this is necessary to promote development or that the lease cannot be successfully operated under the lease terms. No waiver, suspension or reduction of rental or royalty will be granted where the only reason for the request for such relief is the unavailability of power generating facilities to utilize the geothermal steam.

(b) An application hereunder shall be filed in triplicate with the Supervisor, and must: (1) Contain the serial number of the leases and the names of the lessee and operator; (2) show the number, location, and status of each well that has been drilled, a tabulated statement for each month covering a period of not less than 6 months prior to the date of filing the application of the aggregate amount of production subject to royalty computed in accordance with the operating regulations, the number of wells counted as producing each month, and the average production per well per day; (3) contain a detailed statement of expenses and costs of operating the lease, the income from the sale of any leased products and all facts tending to show whether the wells can be successfully operated using the royalty or rental fixed in the lease; and (4) where the application is for a reduction in royalty, furnish full information as to whether royalties or payments out of production are paid to others than to the United States, the amounts so paid, and the efforts made to reduce them. The applicant must also file agreements of the holders to a comparable reduction of all other royalties from the leasehold to an aggregate not in excess of one-half the Government royalties.

§ 3205.3–8 Application for and effect of suspension of operations and production.

(a) Applications by lessees for suspensions of operations or production, or both, under a producing geothermal lease (or for relief from any drilling or producing requirements of such a lease) shall be filed in triplicate with the Supervisor, who is authorized to act on applications filed pursuant to this section and to terminate suspensions which have been or may be granted. Complete information must be furnished showing the necessity of the relief sought.

(b) A suspension shall take effect as of the time specified in the order of the Supervisor. Rental or minimum royalty payments will be suspended during any period of suspension of all operations and production directed, or assented to, by the Supervisor, beginning with the first day of the lease month in which the suspension of operations and production becomes effective or, if the suspension of operations and production becomes effective on any date other than the first day of a lease month, beginning with the first day of the lease month following such effective date. The suspension of rental or minimum royalty payments shall end on the first day of the lease month in which operations or production is resumed. Where rentals are creditable against royalties and have been paid in advance, proper credit will be allowed on the next rental or royalty due under the lease.

(c) No lease shall be deemed to expire by reason of a suspension of either operations or production, pursuant to any order or assent of the Supervisor.

(d) If there is a well on the leased premises capable of producing geothermal resources and all operations and production are suspended pursuant to any order of the Supervisor, approval of recommencement of drilling operations will terminate the suspension as to operations but not as to production, and will terminate both the period of suspension of rental and minimum royalty payments provided in paragraph (b) of this section and the period of suspension for which an equivalent extension will be granted. However, as provided in paragraph (c) of this section, the lease will not be deemed to expire so long as the suspension of operations or production remains in effect.

(e) The relief authorized under this section may also be obtained for any leases included within an approved unit or cooperative plan of development and operation.

(f) See 30 CFR 270.17 for regulations concerning action of the Supervisor on applications filed pursuant to this section.

§ 3205.3–9 Readjustments.

The rentals and royalties of any geothermal lease may be readjusted at not less than 20-year intervals beginning 35 years after the date geothermal steam is produced as determined by the Supervisor. In the event of any such readjustment neither the rental nor royalty paid during the preceding period shall be increased by more than 50 per centum, and in no event shall the royalty payable exceed 22½ per centum. Each geothermal lease shall provide for such readjustment. The Supervisor will give notice of any proposed readjustment of rental or royalties. Unless the lessee relinquishes the lease within 30 days after receipt of such notice, he shall conclusively be deemed to have agreed to such terms and conditions. If the lessee files a protest, and no agreement can be reached between the authorized officer and the lessee within a period of 60 days, the lease may be terminated by either party subject to the provisions of § 3000.4 of this chapter. If the lessee files a protest to the proposed readjusted terms and conditions, the existing terms and conditions will remain in effect until there has been an agreement between the authorized officer and the lessee on the new terms and conditions to be applied to the lease or until the lease is terminated, except payments of any proposed readjusted rentals and royalties must be paid in the timely manner prescribed in these regulations and may be paid under protest. The readjusted terms and conditions will be effective as of the end of the term being adjusted.

§ 3205.4 Rental and minimum royalty liability of lands committed to cooperative or unit plans.

§ 3205.4–1 Prior to production.

All lands within any lease committed to an approved cooperative or unit plan shall at all times prior to production on any of the lands so committed remain subject to rental in accordance with § 3205.3.

§ 3205.4–2 After production.

As soon as production is obtained on or for any lands included in an approved cooperative or unit plan those lands which are included within the participating area of the producing well shall become liable for royalties in accordance with Subpart 3205. All other unitized lands, shall remain subject to rental in accordance with § 3205.3.

Subpart 3206—Lease Bonds

§ 3206.1 Types of bonds and filing.

§ 3206.1–1 Types of bonds.

(a) Bonds shall be either corporate surety bonds or personal bonds except that bonds with individual sureties may be furnished for the protection of the entryman or owner of the surface rights.

(b) Lease compliance bond. The applicant for a noncompetitive lease or the successful bidder for a competitive lease must furnish, prior to the issuance of the lease, and thereafter maintain a bond of not less than $10,000 conditioned on compliance with all the terms of the lease.

(c) Protection bond. A lessee will be required, prior to entry on the leased lands, to furnish and maintain a bond of not less than $5,000 for indemnification for all damages occasioned to persons or property as the result of lease operations.

§ 3206.1–2 Filing of bonds.

A single original copy of the bond on forms approved by the Director must be filed in the proper BLM office. Bonds may be filed with a noncompetitive lease application to expedite action thereon, or within 30 days after receipt of notice by the applicant of the bond requirement, or as required and directed by the authorized officer. For unit bond forms see 30 CFR Part 271.

§ 3206.2 Termination of period of liability.

The period of liability of any bond will not be terminated until all lease terms and conditions have been fulfilled.

§ 3206.3 Operator's bond.

§ 3206.3–1 Compliance.

An operator, or, if there are more than one for different portions of the lease, each operator may furnish a general lease bond of not less than $10,000 in his own name as principal on the bond in lieu of the lessee. Where there is more than operator's bond affecting a single lease, each such bond must be conditioned upon compliance with all lease terms for the entire leasehold.

§ 3206.3–2 Approval.

An operator's bond will not be accepted unless the operator holds an operating agreement which has been approved by the Department or has pending an operating agreement in proper condition for approval. The mere designation as operator will not suffice.

§ 3206.3–3 Default.

Where a bond is furnished by an operator, suit may be brought thereon without joining the lessee if he is not a party to the bond.

§ 3206.4 Personal bond or corporate bond.

§ 3206.4–1 Amount.

In lieu of a surety bond, a personal bond in a like amount may be given by the obligor with the deposit as security therefor of negotiable bonds of the United States of a par value equal to the amount specified in the bond.

§ 3206.4–2 Deposit of securities.

Personal bonds must be accompanied by a deposit of negotiable Federal securities in a sum equal at their par value to the amount of the bond and by a proper conveyance to the Secretary of full authority to sell such securities in case of default in the performance of the conditions of the lease bond.

§ 3206.4–3 Qualified corporate sureties.

Treasury lists. A list of companies holding certificates of authority from the Secretary of the Treasury under the Act of July 30, 1947 (6 U.S.C. 6–13), as acceptable sureties on Federal bonds is published in the FEDERAL REGISTER annually.

§ 3206.5 Nationwide bond.

In lieu of bonds required under any of the preceding paragraphs, the holder of leases or of operating agreements approved by the Department or holder of operating rights by virtue of being designated operator or agent by the lessee pending departmental approval of operating agreements may furnish a bond the amount of which must be not less than $150,000 for full nationwide coverage for all geothermal leases.

§ 3206.6 Statewide bond.

In lieu of any of the bonds required by the preceding paragraphs, the holder of leases or of operating agreements approved by the Department or holder of operating rights by virtue of being designated operator or agent by the lessee pending Departmental approval of operating agreements, may furnish a statewide bond, applicable to the State in which the leases are situated, the amount of which must be not less than $50,000.

§ 3206.7 Default.

§ 3206.7–1 Payment by surety.

Where upon a default the surety makes payment to the Government of any indebtedness due under a lease, the face amount of the surety bond and the surety's liability thereunder shall be reduced by the amount of such payment.

§ 3206.7–2 Penalty.

Thereafter, upon penalty of cancellation of all of the leases covered by that bond, the principal shall post a new nationwide bond in the amount of $150,000 or a new statewide bond in the amount of $50,000 as the case may be, within 6 months after notice, or within such shorter period as the authorized officer may fix. However, in lieu thereof, the principal may within that time file separate bonds for each lease.

§ 3206.8 Applicability of provisions to existing bonds.

The provisions of these regulations may be made applicable to any oil and gas nationwide or statewide bond in force at the effective date of these regulations by filing in the proper BLM office a written consent to that effect and an agreement to be bound by the provisions hereof executed by the principal and the surety. Upon receipt thereof the bond will be deemed to be subject to the provisions of these regulations.

Subpart 3207—[Reserved]

Subpart 3208—[Reserved]

Subpart 3209—Geothermal Resources Exploration Operations

§ 3209.0–1 Purposes.

(a) The regulations in this Subpart establish procedures to be followed in conducting exploration operations on the public land for geothermal resources. The regulations in this subpart are not applicable to exploration operations conducted pursuant to a geothermal resources lease.

(b) The rights obtained under this subpart do not include an exclusive right to prospect for geothermal resources on the land described in a Notice of Intent or any preference right to a geothermal resources lease.

§ 3209.0–2 Objectives.

The regulations in this Subpart encourage exploration of the public lands for geothermal resources in a manner that is consistent with the management policy set forth in § 1725.3 of this chapter. No exploration operations will be allowed if the authorized officer determines that such operations would be inconsistent with that policy. The authorized officer may suspend or terminate exploration operations upon due notice to the operator at any time if he determines that there is non-compliance with the terms and conditions of the Notice of Intent.

§ 3209.0–5 Definitions.

As used in this subpart:

(a) "Exploration operations" means any activity relating to the search for evidence of geothermal resources which requires physical presence upon public lands and which may result in damage to public lands or resources thereon. It includes, but is not limited to, geophysical operations, drilling of shallow temperature gradient wells, construction of roads and trails, and cross-country transit by vehicle over public lands. It does not include the casual use of public lands for geothermal resources exploration. It does not include core drilling for subsurface geologic information, except drilling of shallow temperature gradient wells, or drilling for geothermal resources; these activities will be authorized only by the issuance of a geothermal resources lease. The regulations in this Subpart, however, are not intended to prevent drilling operations necessary for placing explosive charges for seismic exploration, nor do they affect the exclusive right of a lessee to drill for geothermal resources upon the land subject to his lease.

(b) "Notice of Intent" means a "Notice of Intent and Permit to Conduct Exploration Operations (Geothermal Resources)."

(c) "Public lands" means lands owned by the United States and administered by the Bureau of Land Management. It does not include a retained mineral interest in lands, title to which has passed from the United States.

(d) "Casual use" means activities that involve practices which do not ordinarily lead to any appreciable disturbance or damage to lands, resources, and improvements. For example, activities which do not involve use of heavy equipment or explosives and which do not involve vehicle movement except over established roads and trails are "casual use."

§ 3209.1 Notice of intent and permit to conduct exploration operations (Geothermal Resources).

§ 3209.1–1 Application.

(a) *Forms and where filed.* Any persons desiring to conduct exploration operations under the regulations of this subpart shall, prior to entry upon the lands, file for approval with the authorized officer for the district in which the public lands are located a Notice of Intent on a form approved by the Director.

(b) *Requirements.* The Notice of Intent will contain the following:

(1) The name and address, including zip code, both of the person, association, or corporation for whom the operations will be conducted and of the person who will be in charge of the actual exploration activities;

(2) a statement that the signers agree that exploration operations will be conducted pursuant to the terms and conditions listed on the approved form;

(3) a brief description of the type of operations which will be undertaken;

(4) a description of the lands to be explored by township;

(5) a map or maps, available from state or Federal sources, showing the lands to be entered or disturbed by the proposed exploration operations; and

(6) the approximate dates of the commencement and termination of exploration operations.

§ 3209.1–2 Review of Notice of Intent.

The authorized officer will either approve or disapprove a Notice of Intent as promptly as practicable, but in any event within 30 calendar days after the date of the filing of the Notice of Intent. If the authorized officer shall disapprove a Notice of Intent, he shall explain in writing to the applicant the reasons for disapproval.

§ 3209.2 Exploration operations.

No exploration operations will be conducted on public lands except pursuant to the terms of a Notice of Intent which has been approved by the authorized officer.

§ 3209.3 Completion of operations.

Upon completion of the exploratory operations, there shall be filed with the authorized officer a "Notice of Completion of Exploration Operations." Within 90 days after the filing of such "Notice of Completion," the authorized officer shall notify the party who had conducted compliance with all of the terms and conditions set out by the regulations in this Subpart and in the Notice of Intent, or whether any additional measures must be taken to rectify any damage to the land, specifying the nature and extent thereof.

§ 3209.4 Bond requirement.

§ 3209.4–1 General.

(a) Simultaneously with the filing of the Notice of Intent, and before the entry is made on the land, the party or parties filing the Notice of Intent must file with the authorized officer a surety company bond for each exploration operation in the amount of not less than $5,000, conditioned upon the full and faithful compliance with all of the terms and conditions of the regulations in this Subpart and of that Notice of Intent.

(b) A party will be excused from compliance with the requirements of paragraph (a) of this section if he possesses either a nationwide bond in the amount of not less than $50,000 covering all exploration operations or a statewide bond in the amount of not less than $25,000 covering all exploration operations in the State in which the lands on which he has filed the Notice of Intent are situated.

§ 3209.4–2 Riders to existing bond forms.

Holders of nationwide and statewide oil and gas exploration bonds shall be permitted, in lieu of furnishing additional bonds, to amend their bonds to include geothermal resources exploration operations.

§ 3209.4–3 Termination of period of liability.

The authorized officer will not give his consent to the cancellation of the bond if an individual bond was submitted or to the termination of the period of liability if a State or nationwide bond was submitted, unless and until there has been compliance with all of the terms and conditions of the Notice of Intent. Should the authorized officer fail to notify the party within 90 days from the filing of "Notice of Completion" that all terms and conditions have been complied with or that additional corrective measures must be taken to rehabilitate the land, the period of liability under an individual bond or the period of liability for a particular exploration operation under a State or nationwide bond shall automatically terminate on the 91st day.

PART 3210—NONCOMPETITIVE LEASES

Subpart 3210—Noncompetitive Leases; General

Sec.

3210.1 Availability of land.
3210.2–1 Application.
3210.2–2 Submission of applications.
3210.2–3 Withdrawal of application.
3210.2–4 Amendment to lease.
3210.3 Determination of priorities.
3210.4 Rejections.

Subpart 3211—Bureau Motion, Lands Previously Leased for Geothermal Resources

3211.1 Releasing of formerly leased lands.
3211.2 Applications during simultaneous filing periods.
3211.3 Insurance of leases for unit on posted list.

Subpart 3210—Noncompetitive Leases; General

§ 3210.1 Availability of land.

(a) Applications to lease, except for those filed pursuant to Part 3230, of this chapter, filed prior to the effective date of these regulations are unacceptable and will be returned summarily without earning any priority.

(b) Lands and deposits subject to disposition under this part which are not within any KGRA will be available for leasing after the effective date of these regulations. Lands which are available for noncompetitive leasing and which were included in cancelled, relinquished, expired, or terminated leases shall be available for leasing only subject to the provisions of Subpart 3211 of this chapter. All other lands available for noncompetitive leasing will be available for leasing only subject to the provisions of this Subpart. All applications to lease the same lands which are filed between the effective date of these regulations and 30 days following that time will be considered to have been filed simultaneously, and the respective priority of the various applications will be determined by a public drawing. In other respects the first 30 days after the effective date of these regulations shall be treated as an application filing period as provided in § 3210.2–2.

§ 3210.2–1 Application.

An application for a lease must be filed on a form approved by the Director in the proper BLM office in duplicate for public lands and in triplicate where acquired lands are involved. The application must be submitted in a sealed envelope marked "Application for lease pursuant to 43 CFR 3210". An application will be considered filed when it is received in the proper office during business hours. The application must include the following:

(a) The applicant's name and address;

(b) a statement of applicant's citizenship and qualifications;

(c) a complete and accurate description of the lands applied for, which must include all available lands, including reserved geothermal resources, within a surveyed or protracted section, or, if the lands are neither surveyed or protracted and are described by metes and bounds, all the lands which will be included in a section when the lands are surveyed or protracted;

(d) a proposed plan which shall include: (1) A map, or maps, available from State or Federal sources, showing the topography of the land applied for, on which the applicant shall show drainage patterns, present road and trail locations, present utility systems, proposed road and trail location, proposed well locations and potential surface disturbance, and (2) a narrative statement setting forth his proposed plan and methods for diligent exploration. Such plan shall provide for a program of diligent exploration as defined in § 3203.5 of this chapter.

The narrative statement shall also describe the measures proposed to be taken to prevent or control fire, soil erosion, pollution of surface and ground water, damage to fish and wildlife or other natural resources, air and noise pollution and hazards to public health and safety during lease activities. However, the proposed plan required by this paragraph need not be submitted with the application during the initial, 30-day simultaneous filing period provided by § 3210.1(b) or during any application filing period pursuant to § 3210.2–2, but must be filed prior to the issuance of the lease, upon notice from the authorized officer; and

(e) a statement that the applicant does not hold, own, or control any interest, direct or indirect, in other Federal geothermal leases in the same State in excess of 20.480 acres.

§ 3210.2–2 Submission of applications.

Except for applications filed during the first 30 days after the effective date of these regulations, applications for leases pursuant to this subpart shall submitted only during application filing periods. An application filing period shall begin on the first working day of each calendar month and shall end at the close of business on the last working day of that month. The first application filing period shall begin on the first working day of the month following the conclusion of the initial 30 day filing period provided in § 3210.1(b). No applicant shall file during the same application filing period a second application which overlaps any of the land covered by his first application. When an application is filed with the authorized officer, the date of filing shall be stamped on the envelope. The envelope containing the application shall remain sealed until the end of the application filing period during which the application is filed. On the first working day following the end of the application filing period all applications shall be opened, and it will be determined which applications are for lands included in a KGRA. In determining whether land included in an application is a KGRA because of competitive interest, no application submitted during any subsequent application filing period will be considered. Applications for land determined to be KGRA will be rejected. All other applications will be assigned priority according to the date of filing. If any application covers both land within a KGRA and land outside a KGRA, the applicant will be granted the opportunity to amend his application to exclude the portion included in a KGRA, and his amended application will be assigned priority according to the date of filing of his original application, but must comply with all other requirements of these regulations.

§ 3210.2–3 Withdrawal of application

An application may not be withdrawn, either in whole or in part, unless the request is received by the proper BLM office before the lease or an amendment of the lease, whichever covers the land described in the withdrawal, has been signed on behalf of the United States even though the effective date of the lease is subsequent to the date of filing of the withdrawal, except where a separate conflicting lease has been signed on behalf of the United States covering the land described in the withdrawal.

§ 3210.2–4 Amendment to lease.

If any of the land applied for was open to filing when the application was filed but is omitted from the lease for any reason and thereafter becomes available for noncompetitive leasing, the original lease will be amended to include the omitted land unless, before the issuance of the amendment, the proper BLM office receives a withdrawal of the lessee's application with respect to such land or such omitted lands have been determined to be within a KGRA. The lease term for the land added by such an amendment shall be the same as if the land had been included in the original lease when it was issued.

§ 3210.3 Determination of priorities.

(a) No lease shall be issued before final action has been taken on (1) any prior application to lease the land, (2) any subsequent application to lease the land that is based upon a claimed preferential right, and (3) any petition for the renewal or reinstatement of an existing or former lease on the land.

(b) Where a lease is issued before final action has been taken on such applications and petitions, it shall be canceled, and the advance rental returned, after due notice to the lessee, where the applicant or petitioner is found to be qualified and entitled to receive a lease of the land.

(c) Applications for lease received in the mail or delivered on the same day will be deemed to have been simultaneously filed, and the right of priority and the order of processing will be determined by a public drawing.

(d) Prior to the issuance of any lease, a determination shall be made as to whether or not the lands are within a KGRA. Applications for lands determined to be within any KGRA will be rejected.

§ 3210.4 Rejections.

If, after the filing of an application for a noncompetitive lease and before the issuance of a lease, or amendment thereto, pursuant to that application, the land embraced in the application becomes included within a KGRA, the application will be rejected as to such KGRA lands. The authorized officer retains discretion to reject an application for a noncompetitive lease even though the tract for which application is made is not determined to be within a KGRA.

Subpart 3211—Bureau Motion—Land Previously Leased for Geothermal Resources

§ 3211.1 Releasing of formerly leased lands.

Lands available for noncompetitive leasing in canceled or relinquished leases or in leases which expire by operation of law at the end of their primary or extended terms or in leases which terminate by operation of law for nonpayment of rental pursuant to 30 U.S.C. sec. 1004, shall be subject to further leasing only in accordance with the provisions of this section. From time to time the authorized officer will publish in the Federal Register, post in each proper BLM office, and provide appropriate news coverage of:

(a) A list of leasing units composed of lands which are available for noncompetitive leasing and which were in canceled, expired, relinquished, or terminated leases.

(b) An announcement that applications for leases on such lands will be received after a specific hour and date and that any applications filed during a specified simultaneous filing period beginning at that time will be regarded as simultaneously filed;

(c) The address of the proper BLM office where applications must be filed and where the terms and conditions under which the lease will be issued are available; and

(d) Requirements for a complete application, indicating that the proposed plan of operation, as required by § 3210.-2-1(d) of this chapter, will not be required until there has been a drawing and a consequent determination of priority, but must be filed prior to the issuance of the lease, upon notice from the authorized officer.

§ 3211.2 Applications during simultaneous filing periods.

(a) An application shall conform to the requirements of § 3210.2–1 of this chapter, except as provided below.

(b) Only one complete leasing unit, identified by unit number, may be included in an application. Lands not on the published list may not be included in the application.

(c) An applicant is permitted to file only one application for each numbered unit on the posted list. Submission of more than one application by or on behalf of the applicant for any unit on the posted list will result in the disqualification of all applications submitted by that applicant for the drawing to be held for that particular unit.

(d) The application must be accompanied by a signed statement that the applicant will furnish the information required by these regulations within 15 days after notification that his application is the only one for the tract, or that he is the successful drawee.

(e) Each application filed during a simultaneous filing period must be submitted in a sealed envelope marked "Application for a lease pursuant to 43 CFR subpart 3211". The envelope will remain sealed until the end of the 30-day simultaneous filing period, at which time the application will be time-stamped simultaneously and serialized. A public drawing of all applications received during the simultaneous 30-day period will be held to determine respective priorities and order of processing.

(f) Applications filed during a simultaneous filing period are subject to the classification criteria established in § 3200.0–5(k) of this chapter, and will be considered as all filed the same day.

(g) The requirements of § 3210.2–1(d) of this chapter requiring a proposed plan of operation need not be satisfied for a complete application during the 30-day simultaneous filing period or during any future designated simultaneous filing period. Such plan must be filed by the successful drawee prior to the issuance of the lease, upon notice from the authorized officer.

(h) Each application must be accompanied by the service charge of $50. The first year's advance rental need not be submitted with the application. A lease may be issued to the first drawee qualified to receive a lease upon payment of the first year's rental. Rental must be received in the proper BLM office within fifteen days from the date of receipt of notice that such rental is due. The drawee failing to submit the rental payment within the time allowed will be automatically disqualified to receive the lease, and consideration will be given to the application of the drawee having the next highest priority in the drawing.

§ 3211.3 Issuance of leases for units on posted list.

(a) If more than one application is received during the simultaneous filing period for the same unit on the list posted pursuant to § 3211.1(a), all applications on that unit filed during that period will be considered simultaneously filed. Priority of filing for such units will be determined by a public drawing. Three applications will be drawn for each unit, and the order in which they are drawn will fix the order in which the successful drawee will be determined. Where less than three applications have been filed, all applications will be drawn to determine priority.

If the lands are determined not to be within any KGRA, a lease may be issued to the successful drawee upon his compliance with all applicable regulations, including those in Subpart 3210 of this chapter.

(b) If only one application is filed during the simultaneous filing period on a unit on the list posted pursuant to § 3211.1(a), a lease on that unit, if the land is not included within any KGRA, may be issued to the applicant, upon his compliance with all applicable regulations, including those in Subpart 3210 of this chapter.

(c) If no application is filed on a unit on the list posted pursuant to § 3211.1 (a) within the prescribed simultaneous filing period, the land in that unit, if not within a KGRA, will become available for leasing in accordance with Subpart 3210 of this chapter.

PART 3220—COMPETITIVE LEASES

Subpart 3220—Competitive Leases; General

Sec.
3220.1 General.
3220.2 Nominations.
3220.3 Publication of notice of lease sale.
3220.4 Contents of notice of lease sale.
3220.5 Bidding requirements.
3220.6 Award of lease.

Subpart 3220—Competitive Leases; General

§ 3220.1 General.

(a) Lands within a KGRA, except as provided under § 3201.1 of this chapter, will be available for leasing on the effective date of these regulations.

(b) The authorized officer will accept nominations to lease, or may on his own motion from time to time call for nominations to lease. Nominations may be withdrawn at any time.

§ 3220.2 Nominations.

(a) Nominations will be submitted on a card approved by the Director.

(b) A nomination must be filed in the proper BLM office in duplicate for public lands and triplicate where acquired lands are involved and must include the following:

(1) The nominator's name and address;

(2) A statement of citizenship and qualifications for lease;

(3) A description of the lands; and

(4) A statement of the interests, direct or indirect, held in other Federal geothermal leases in the same State.

§ 3220.3 Publication of notice of lease sale.

Where the Secretary determines to offer lands for competitive leasing he will publish a notice of lease sale in a newspaper of general circulation in the area in which the lands to be leased are located once a week for 4 consecutive weeks, or for such other period as he may direct.

§ 3220.4 Contents of notice of lease sale.

The notice will specify the time and place of sale, the manner in which bids may be submitted, the description of the lands, and the terms and conditions of the sale, including royalty and rental rates.

The notice will indicate the proper BLM office where the terms and conditions under which the lease will be issued are available. The notice will also indicate that the proposed plan of operation, as required by § 3210.2–1(d) of this chapter, must be filed before a lease can be issued.

§ 3220.5 Bidding requirements.

(a) A separate identified sealed bid must be submitted for each lease unit. Each bidder must submit with his bid a certified or cashier's check, bank draft, money order or cash in the amount of one-half of the amount bid together with proof of qualifications as required by these regulations.

(b) All bidders are warned against violation of the provisions of Title 18 U.S.C. section 1860 prohibiting unlawful combination or intimidation of bidders.

§ 3220.6 Award of lease.

(a) All sealed bids shall be opened at the place, date, and hour specified in the notice. No bids will be accepted or rejected at that time.

(b) Leases will be awarded to the highest responsible qualified bidder, except as required under Part 3230 of this chapter.

(c) The right to reject any and all bids is reserved. If the authorized officer fails to accept the highest bid for a lease within 30 days after the date on which the bids are opened (or such longer period as may be needed to comply with § 3230.1–6 of this chapter), all bids for that lease will be considered rejected. Deposits on rejected bids will be returned.

(d) If the lease is awarded, three copies of the lease will be sent to the successful bidder who shall be required to execute them within 30 days from receipt thereof, to pay the first year's rental, the balance of the bonus bid, file the required bond or bonds, and submit the proposed plan of operation as required by § 3210.–2–1(d) of this chapter. When the three copies of the lease are executed by the successful bidder and returned to the authorized officer, the lease will be executed by the authorized officer and a copy will be mailed to the lessee.

(e) If the successful bidder fails to execute the lease or otherwise comply with the applicable regulations, his deposit will be forfeited and disposed of as provided in section 20 of the Act. In this event the lands will be reoffered when it is determined, in the opinion of the Secretary, that sufficient interest exists to justify a competitive lease sale.

PART 3230—RIGHTS TO CONVERSION TO GEOTHERMAL LEASES OR APPLICATION FOR GEOTHERMAL LEASES

Subpart 3230—Rights to Conversion to Geothermal Leases or Application for Geothermal Leases; General

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3230.1 General.
3230.1–1 Rights to conversion to geothermal leases.
3230.1–2 Rights to conversion to applications for geothermal leases.
3230.1–3 Land in which minerals are reserved to the United States.
3230.1–4 Conflicting claims of rights to conversion to geothermal leases, or to applications for geothermal leases.
3230.1–5 Evidence required to qualify for grant of rights to conversion to geothermal leases, or to applications for geothermal leases.
3230.1–6 Method of leasing to owners of conversion rights to geothermal leases, or to applications for geothermal leases.
3230.1–7 Acreage limitation.
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3230.3–1 Filing of application.
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3230.4 Conversion to geothermal leases or to applications for geothermal leases.
3230.4–1 Processing and adjudicating applications.

Subpart 3230—Rights to Conversion to Geothermal Leases or Application for Geothermal Leases

§ 3230.1 General.

§ 3230.1–1 Rights to conversion to geothermal leases.

Where lands were on September 7, 1965, subject to valid leases or permits issued under the Mineral Leasing Act of 1920, as amended and supplemented (30 U.S.C. 181–287), or the Mineral Leasing Act for Acquired Lands, as amended (30 U.S.C. 351–358), or subject to existing mining claims located on or prior to September 7, 1965, the lessees, permittees, or claimants, or their successors in interest, if qualified to hold geothermal leases, shall have the right, subject to certain limitations as hereinafter provided, to convert such leases, permits or claims to geothermal leases covering the same lands. Upon issuance of a geothermal lease based upon the exercise of conversion rights hereunder, such outstanding leases, permits, or mining claims shall be deemed to be terminated or relinquished, respectively.

§ 3230.1–2 Rights to conversion to applications for geothermal leases.

Where lands were subject to application for leases or permits under the mineral leasing laws referred to in § 3230.1–1 on September 7, 1965, the applicants may, subject to certain limitations as hereinafter provided, convert their applications to applications for geothermal leases having priorities dating from the time of filing such applications under said mineral leasing laws. Upon issuance of a geothermal lease based upon the exercise of conversion rights hereunder, such pending applications for leases or permits shall be deemed to be withdrawn.

§ 3230.1–3 Land in which minerals are reserved to the United States.

Where a right to one of the forms of conversion referred to in § 3230.1–1 or § 3230.1–2 is claimed as to lands the surface of which has passed from Federal ownership but in which the minerals have been reserved to the United States, final action on any claim to conversion rights under section 4 of the Act shall be held in abeyance until such time as the question of title to the geothermal resources in such lands has been resolved pursuant to the provisions of section 21(b) of the Act, unless the Secretary determines that it is in the public interest to make a determination of such claims at an earlier time, subject to the rights, if any, of surface owners.

§ 3230.1–4 Conflicting claims of rights to conversion to geothermal leases, or to applications for geothermal leases.

(a) Where there are conflicting claims of rights to conversion to geothermal leases based upon mineral leases, mineral permits, or mining claims embracing the same land, the date of issuance of the permit or lease or of recordation of the claim shall determine priority.

(b) Where there are rights to conversion to applications for geothermal leases based on applications for mineral leases or permits in conflict with rights to conversion to geothermal leases based upon mining claims embracing the same lands, the mining claim right to convert to a geothermal lease shall have priority. If the applicant for a geothermal lease based upon a mining claim fails to qualify for any reason, the application for an application for a geothermal lease is entitled to priority based on the date of filing the application for a mineral lease or permit.

§ 3230.1–5 Evidence required to qualify for grant of rights to conversion to geothermal leases, or to applications for geothermal leases.

(a) Any person claiming rights to conversion to a geothermal lease must show to the reasonable satisfaction of the authorized officer that substantial expenditures for the exploration, development or production of geothermal steam, but not associated geothermal resources, were made by the applicant who is seeking the conversion on the lands for which a lease is sought or on adjoining, adjacent or nearby lands, including both Federal and non-Federal lands. The substantial expenditures must have been made prior to December 24, 1970, and either by the applicant seeking conversion or by his predecessors in interest.

(b) For purposes of these regulations, an application for a lease or a permit, filed pursuant to applicable mineral leasing acts, pending on September 7, 1965, which subsequently ripened into a lease or permit, and which remains outstanding or has either terminated, expired or been canceled or relinquished, retains the right to conversion to an application for a geothermal lease. Applications for a lease or permit, filed pursuant to applicable mineral leasing acts, pending on September 7, 1965, which were subsequently withdrawn, retain the right to conversion to an application for a geothermal lease. Leases or permits issued pursuant to the applicable mineral leasing acts and outstanding on September 7, 1965, which were subsequently terminated, expired, or were canceled or relinquished, retain the right to conversion to a geothermal lease.

§ 3230.1–6 Method of leasing to owners of conversion rights to geothermal leases, or to applications for geothermal leases.

(a) *Lands included within any KGRA*—(1) *Competitive lease.* Where lands have been included within any KGRA prior to the issuance of a lease, the owner of a conversion right to a geothermal lease for such lands shall be entitled to the issuance of a competitive lease only in accordance with the provisions of subparagraph (2) of this paragraph. If the lands subject to a conversion right to a geothermal lease are in part within a KGRA and in part outside a KGRA, the holder of that conversion right shall have the right to divide his conversion right into two separate conversion rights so that he may receive a geothermal lease to the lands within the KGRA only subject to subparagraph (2) of this paragraph and a geothermal lease to the lands not within a KGRA subject to paragraph (b) of this section.

(2) *Preference right.* (i) Lands which have been included within any KGRA shall be leased only by competitive bidding in the manner prescribed in Subpart 3220 of this chapter, except that, in addition, the name and address of the applicant for any conversion right to a geothermal lease will be set forth in the lease sale notice.

(ii) The person owning the right to conversion to a geothermal lease shall be informed by written notice of the highest bona fide bid submitted for the lease at the sale. If within thirty (30) days after he has received that written notice, the person owning the right to conversion to a geothermal lease shall inform the authorized officer that he wishes such a lease, pay an amount equal to the highest bona fide bid submitted, pay the rental for the first year, file the required bond or bonds, and submit the data required by § 3210.2–1(d) and (e) of this chapter, a lease will be issued to him.

(iii) Failure of the owner of the right to conversion to a geothermal lease to inform the authorized officer timely will constitute a forfeiture of his conversion rights without further notice to him. In this event, the lease will be offered to the highest bona fide bidder, if otherwise qualified.

(iv) Where no bids are received, the person owning the right to conversion to a geothermal lease will not be awarded the lease. Failure of the owner of the right to conversion to submit a bona fide bid or to meet the high bid for the tract offered at the sale will constitute a forfeiture of his conversion right without further notice.

(b) *Lands not included within any KGRA—Noncompetitive lease.* Where lands have not been included within any KGRA prior to the issuance of a lease, the owner of a conversion right to a geothermal lease for such lands, if otherwise qualified, shall be entitled to the issuance of a noncompetitive lease for such lands.

(c) *Lands included within a KGRA*—(1) *Application for a lease.* Where lands have been included within a KGRA prior to the isusance of a lease, the owner of a conversion right to an application for a geothermal lease to those lands shall be entitled to receive a competitive geothermal lease only in accordance with the provisions of Subpart 3220 of this chapter. If the lands subject to a conversion right to a geothermal application are in part within a KGRA and in part outside a KGRA, the holder of that conversion right may amend his application to cover only the land outside the KGRA.

(2) *Preference right.* The owner of a conversion right to an application for a geothermal lease where the lands have been included within a KGRA shall receive no preference right to meet the highest bona fide bid.

(d) *Lands not included within any KGRA*—(1) *Application for a lease.* Where lands have not been included within a KGRA, the owner of a conversion right to an application for a geothermal lease, if otherwise qualified, shall be entitled to convert his right into an application for a non-competitive lease.

(2) *Preference right.* The owner of a conversion right to an application for a geothermal lease where the lands have not been included within a KGRA, if otherwise qualified, shall be entitled to the issuance of a non-competitive geothermal lease for such lands in accordance with Subpart 3210 of this chapter.

§ 3230.1–7 Acreage limitation.

No person shall be permitted to obtain, through conversion of mineral leases or prospecting permits, or applications therefor, or mining claims, leases for more than 10,240 acres, or a lease to any land not included in the lease, permit, application or claim converted, except that any such geothermal lease issued may include some lands not embraced in the lease, permit, application or claim on which the conversion right is based, where a metes and bounds description was used to describe lands in issued leases or permits or in filed applications or mining claim locations. In such event, the metes and bounds description will be conformed by the authorized office to a legal subdivision, to the extent possible.

§ 3230.2 Qualifications.

Persons who believe they are qualified under the Act to convert mineral leases or permits or existing mining claims to geothermal leases and persons who believe they are entitled to convert applications for mineral leases and permits to applications for geothermal leases shall comply with the procedures set forth below.

§ 3230.3 Applications.

§ 3230.3–1 Filing of application.

(a) A person seeking to convert a lease, permit, or application therefor, or a mining claim to a geothermal lease or application must have filed a written application on or before June 22, 1971. If such an application has been filed and does not contain the information specified in § 3230.3–2, such information must be supplied by the applicant within 60 days of the effective date of these regulations.

(b) Failure to have filed a conversion right application on or before June 22, 1971, will result in the loss of any such rights so claimed.

§ 3230.3–2 Statements required.

(a) An application based on a valid lease or permit referred to in section 3230.1–1 hereof shall include the date of issuance, the State in which the lands are located, and the serial number of the lease or permit. An application based on a mining claim referred to in § 3230.1–1 shall include the name, location, legal description or reference sufficient to identify the lands on the ground, date of location and date and place of recordation of the mining claim (including volume and page), which the applicant seeks to convert to a geothermal lease. An application based on an application for a mineral lease or permit referred to in § 3230.1–1 shall include the date the application for the lease or permit was filed with the Bureau of Land Management and the location of the proper BLM office where the application was filed, and should indicate the serial number assigned to the application.

(b) An application shall include a description of the lands sought to be included in a geothermal lease. If the lands have been surveyed under the public land rectangular survey system, each application shall describe the lands by legal subdivision, section, township, and range. If otherwise officially surveyed, the lands shall be described by the legal description, mining claim survey, or irregular tracts. If the lands have not been so surveyed, but protracted surveys for those lands have been approved and the effective date thereof published in the FEDERAL REGISTER, each application for lands shown on such protracted surveys, filed on or after such effective date, shall describe the lands according to the legal subdivision, section, township, and range shown on the approved protracted surveys. If the lands have not been so surveyed, or included within approved protracted surveys, or it is otherwise appropriate, each application shall describe the lands by metes and bounds, giving courses and distances between the successive angle points on the boundary of the tract, and connected by courses and distances to a monument or to a prominent topographic feature.

(c) An application shall be accompanied by a detailed statement showing: (1) The expenditure made for the exploration, development, or production of geothermal steam, but not associated geothermal resources, on lands for which a geothermal lease is sought or on adjoining, adjacent or nearby Federal or non-Federal lands and the date or dates such expenditures were made, (2) the names and current addresses of the persons who actually performed the aforesaid exploration, development, or production work, (3) the geological, geophysical, and engineering data acquired in such exploration, development, or production which demonstrates, or tends to demonstrate the expenditures claimed, (4) a map showing the location where the expenditures and improvements were made, (5) a proposed plan as required by § 3210.2–1(e) of this chapter, and (6) a statement that he will be bound by the terms and conditions of a lease, if issued. The applicant shall file such additional information with respect to the application as requested by the authorized officer.

§ 3230.4 Conversion to geothermal leases or to applications for geothermal leases.

§ 3230.4–1 Processing and adjudicating applications.

Application for conversion to geothermal leases or to applications for geothermal leases together with all information and data submitted or requested by the authorized officer pursuant to § 3230.3–2 and any other pertinent available information or data shall be reviewed by the authorized officer to determine whether the required showing has been made, and thereafter the authorized officer shall prepare a proposed determination which shall be submitted to the Secretary, who will make a determination that the applicant has or has not satisfactorily shown that he is entitled to receive the grant of a geothermal lease, or application for a geothermal lease.

PART 3240—RULES GOVERNING LEASES

Subpart 3240—Rules Governing Leases

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Subpart 3241—Assignments and Transfers

§ 3241.1 Assignments, transfers, interests, qualifications.

§ 3241.1–1 Record title assignments or transfers of leases or undivided lease interests.

(a) The record title of leases may be assigned as to all or part of the leased acreage, except that no assignment will be approved where (1) either the assigned or retained portions created by the assignment would be less than 640 acres, unless the total acreage in the lease being partially assigned includes an irregular subdivision, as provided in § 3203.2 of this chapter in which case the assigned and retained portions may be less than 640 acres by an amount which is smaller than the amount by which the area would be more than 640 acres if the irregular subdivision were added, or (2) an undivided interest is created by assignment of a lease containing less than 640 acres, or (3) where the lease being assigned contains 640 acres or more, an undivided interest of less than 10 percent would be created in the leased acreage. An exception to the minimum acreage provision of this section may be made by the Secretary where he finds such exception is necessary in the interest of conservation of the resources.

(b) A working interest or operating right may be assigned, in accordance with this section, *Provided* That the assigned interest or right, divided or undivided, vests in the holder only the right to explore, develop and produce geothermal resources from the leased lands to the extent of not less than the interest assigned.

(c) All requests for approval of any assignment will be reviewed, prior to approval, to adjust environmental terms and conditions where necessary.

§ 3241.1–2 Qualifications.

(a) No assignment will be approved (1) if the assignee or any other party in interest is not qualified to take and hold a lease; (2) if a required bond is not filed; or (3) if the statement of interest required under § 3202.2–1(a) of this chapter is not filed.

(b) An assignment to a minor other than an heir or devisee of a lessee will not be approved.

(c) The assignment must be accompanied by a signed statement by the assignee either (1) that he is the sole party in interest in the assignment, or (2) setting forth the names and qualifications of the other parties holding interests in the lease. Where the assignee is not the sole party in interest, separate statements must be signed by each of the parties setting forth the nature and extent of the interest of each party and the nature of the agreement between them.

(d) Where an attorney-in-fact or agent signs, on behalf of the assignor or assignee, the instrument of transfer or the application for approval, evidence of the authority of the attorney-in-fact or agent to sign such assignment or application must be furnished to the authorized officer.

(e) For the heir or devisee of the deceased holder of a lease, an operating agreement, or an overriding royalty interest in a producing lease, to be recognized by the authorized officer as the holder of that lease, agreement or interest, the appropriate showing required under the regulations in § 3202.2–6 of this chapter must be furnished to the authorized officer.

§ 3241.2 Requirements for filing of assignments or transfers.

§ 3241.2–1 Place of filing and service charge.

A request for approval of any assignment or other instrument of transfer of a lease or interest therein must be filed in the proper BLM office and accompanied by a nonrefundable service charge of $50. An application request not accompanied by payment of such a service charge will not be accepted for filing.

§ 3241.2–2 Number of copies required.

Three copies of all instruments of assignment or transfer, and a single copy of any additional information required by § 3202.2 of this Chapter relating to citizenship or qualification of corporations and associations, including partnerships, must be filed in the proper BLM office.

§ 3241.2–3 Time of filing assignments, transfers of leases, or undivided lease interests.

(a) Any assignment or instrument of transfer of a lease or of an interest therein, including an assignment of working interests, operating agreements, and operating rights, must be filed in the proper BLM office for approval within 90 days from the date of execution of that instrument and must contain all of the terms and conditions agreed upon by the parties thereto, together with evidence and statements similar to that required of an applicant under these regulations in this group.

(b) A separate instrument of assignment must be filed in the proper BLM office for each geothermal lease involving transfers of record title. When transfers to the same person, association, including partnerships, or corporation involve more than one geothermal lease, one request for approval and one showing as to the qualifications of the assignee will be sufficient.

§ 3241.2–4 Forms and statements.

A form approved by the Director, or unofficial copies of that form in current use, must be used for transfers and requests for approval referred to in this section and must be filed in duplicate for public lands and in triplicate where acquired lands are involved. The approved form may be used for an assignment which affects a transfer of the record title to all or part of a geothermal lease, but it is not to be used for any other type of transfer. The application for assignment shall be deemed to be approved upon execution by the authorized officer.

§ 3241.2–5 Description of lands.

Each instrument of transfer must describe the lands involved in the same manner as described in the lease.

§ 3241.3 Bonds.

Where an assignment does not create separate leases, the assignee, if the assignment so provides, may become a joint principal on the bond with the assignor. Any assignment which does not convey the assignor's record title in all of the lands in the lease must also be accompanied by consent of his surety to remain bound under the bond of record as to the lease retained by said assignor, if the bond, by its terms, does not contain such consent. If a party to the assignment has previously furnished a nationwide or statewide bond, no additional showing by such party is necessary as to the bond requirement.

§ 3241.4 Approval.

Upon approval, an assignment shall be effective as of the first day of the lease month following the date of filing of the assignment.

§ 3241.5 Continuing responsibility.

(a) The assignor and his surety will continue to be responsible for the performance of any obligation under the lease until the assignment is approved.

(b) Upon approval, the assignee and his surety shall be responsible for the performance of all lease obligations notwithstanding any terms in the assignment to the contrary.

§ 3241.6 Production payments.

If payments out of production are reserved, a statement must be submitted stating the details as to the amount, method of payment, and other pertinent items.

§ 3241.7 Overriding royalty interests.

§ 3241.7–1 General.

(a) Overriding royalty interests in geothermal leases constitute accountable acreage holdings under these regulations.

(b) If an overriding royalty interest is created which is not shown in the instrument of assignment or transfer, a statement must be filed in the proper BLM office describing the interest.

(c) Any such assignment will be deemed valid if accompanied by a statement over the assignee's signature that the assignee is a citizen of the United States, an association of such citizens, or a corporation organized under the laws of the United States or of one of the States or the District of Columbia, and that his interests in geothermal leases do not exceed the acreage limitations provided in these regulations.

(d) All assignments of overriding royalty interests must be filed for record in the proper BLM office within 90 days from the date of execution. Such interests will not receive formal approval.

§ 3241.7–2 Limitation of overriding royalties.

(a) Except as herein provided, an overriding royalty on the value of the output of all geothermal resources, or any of them, at the point of shipment to market may be created by assignment or otherwise: *Provided,* That, (1) the overriding royalty is not for less than one-fourth (¼) of 1 percent of the value of such output, and does not exceed 50 percent of the rate of royalty due to the United States as specified in the geothermal lease, or as reduced pursuant to such lease, and (2) the overriding royalty, when added to overriding royalties previously created, does not exceed the maximum rate established herein.

(b) The creation of an overriding royalty interest that does not conform to the requirements of paragraph (a) of this section shall be deemed a violation of the lease terms, unless the agreement creating overriding royalties provides (1) for a prorated reduction of all overriding royalties so that the aggregate rate of royalties does not exceed the maximum rate established in paragraph (a) of this section and (2) for the suspension of an overriding royalty during any period when the royalties due to the United States have been suspended pursuant to the terms of the geothermal lease.

§ 3241.8 Lease account status; requirements.

Unless the lease account is in good financial standing as to the area covered by an assignment at the time the assignment and bond are filed, or is placed in good standing before the assignment is reached for action, the request for approval of the assignment will be denied, and the lease shall be subject to termination in accordance with these regulations.

§ 3241.9 Effect of assignment.

An assignment of the record title of the complete interest in a portion of the lands in a lease shall segregate the assigned and retained portions into separate and distinct leases. An assignment of an undivided interest in the entire leasehold shall not segregate the lease into separate or distinct leases.

Subpart 3242—Production and Use of Byproducts

§ 3242.1 General.

Where the Supervisor determines that production, use, or conversion of geothermal steam under a geothermal lease is susceptible of producing a valuable byproduct or byproducts, including commercially demineralized water contained in or derived from such geothermal steam for beneficial use in accordance with applicable State water laws, the authorized officer shall require substantial beneficial production or use thereof, except where he determines that:

(a) Beneficial production or use is not in the interest of conservation of natural resources;

(b) beneficial production or use would not be economically feasible; or

(c) beneficial production and use should not be required for other reasons satisfactory to him.

§ 3242.2 Production and use of commercially demineralized water as a byproduct, production, and use of other sources of water.

§ 3242.2–1 General.

Except as provided in these regulations, or the lease, the lessee shall have the right to process fluids, including brine, condensate, and other fluids, which are associated with geothermal steam within lands subject to the geothermal lease for the purpose of developing, producing, and utilizing the commercially demineralized water recovered as a result of such processing.

§ 3242.2–2 Prohibition on production of commercially demineralized water.

The lessee shall not be authorized to engage in the primary production of commercially demineralized water from the produced fluids contained in or derived from geothermal steam referred to in § 3242.2–1, where such use would result in the undue waste of geothermal energy.

§ 3242.2–3 Water wells on geothermal areas.

All leases issued under these regulations shall be subject to the condition that, where the lessee finds only potable water in any well drilled for production of geothermal resources, the Secretary may, when the water is of such quality and quantity as to be valuable and useable for agricultural, domestic, or other purpose, acquire the well with casing installed in the well at the fair market value of the casing.

§ 3242.2–4 State water laws.

Nothing in these regulations shall constitute an express or implied claim or denial on the part of the Federal Government as to its exemption from State water laws.

Subpart 3243—Cooperative Conservation Provisions

§ 3243.1 Cooperative or unit plans.

To conserve the natural resources of any geothermal pool, field or like area more properly, lessees and their representatives may unite with each other or jointly or separately with others, in collectively adopting and operating under a cooperative or unit plan of development or operation or any geothermal resource area, or any part thereof (whether or not any part of that geothermal resource area is then subject to any cooperative or unit plan of development or operation). Applications to unitize shall be filed with the Supervisor who shall certify whether such plan is necessary or advisable in the public interest. The procedure in obtaining approval of a cooperative or unit plan of development, the provisions for the supervision of the cooperative or unit plan, and a suggested text of an agreement, are contained in 30 CFR Part 271.

§ 3243.2 Acreage chargeability.

All leases committed to any unit or cooperative plan approved or prescribed by the Supervisor shall be excepted in determining holdings or control for purposes of acreage chargeability. For the extension of leases committed to a unit plan, see Subpart 3203 of this part.

§ 3243.3 Communitization or drilling agreements.

§ 3243.3–1 Approval.

(a) The Supervisor is authorized, when separate tracts under lease cannot be independently developed and operated in conformity with an established well-spacing or well-development program, to approve, or to require lessees to enter into, communitization or drilling agreements providing for the apportionment of production or royalties among the separate tracts of land comprising the drilling or spacing unit for the lease, or any portion thereof, with other lands, whether or not owned by the United States, when in the public interest. Operations or production pursuant to such an agreement shall be deemed to be operations or production as to each lease committed thereto.

(b) Preliminary requests to communitize separate tracts shall be filed in triplicate with the Supervisor.

(c) Executed agreements shall be submitted to the Supervisor in sufficient number to permit retention of five copies after approval.

§ 3243.3–2 Requirements.

The agreement shall describe the separate tracts comprising the drilling or spacing unit, disclose the apportionment of the production or royalties to the several parties and the name of the operator, and shall contain adequate provisions for the protection of the interests of all parties, including the United States. The agreement must be signed by or in behalf of all interested necessary parties and will be effective only after approval by the Supervisor.

§ 3243.4 Operating, drilling, development contracts or a combination for joint operations.

§ 3243.4–1 Approval.

(a) The Secretary may on such conditions as he may prescribe, approve operating, drilling, or development contracts made by one or more geothermal lessees, with one or more persons, associations, including partnerships, or corporations whenever he shall determine that such contracts are required for the conservation of natural resources or in the best interest of the United States.

(b) Contracts submitted for approval under this section should be filed with the Supervisor together with enough copies to permit retention of five copies after approval.

(c) The authority of the Secretary to approve operating, drilling, or development contracts without regard to acreage limitations ordinarily will be exercised only to permit operators to enter into contracts with a number of lessees sufficient to justify operations on a large scale for the discovery, development, production, or transmission, transportation, or utilization of geothermal resources, and to finance the same.

§ 3243.4–2 Requirements.

(a) The contract must be accompanied by a statement showing all the interests held by the contractor in the area or field and the proposed or agreed plan of operation or development of the field. All the contracts held by the same contractor in the area or field should be submitted for approval at the same time, and full disclosure of the project made. Complete details must be furnished so the Secretary may have facts upon which to make a definite determination in accordance herewith and to prescribe the conditions on which approval of the contracts shall be made.

(b) The application must show a reasonable need for the contract and that it will not result in any concentration of control over the production or sale of geothermal resources which would be inconsistent with the antimonopoly provisions of law.

§ 3243.4–3 Acreage chargeability.

All leases operated under approved operating, drilling or development contracts shall be excepted in determining holdings or control for purposes of acreage chargeability.

Subpart 3244—Terminations and Expirations

§ 3244.1 Relinquishments.

(a) A lease, or any legal subdivision of the area covered by such lease, may be relinquished by the record title holder by filing a written relinquishment in triplicate in the proper BLM office, provided the partial relinquishment does not reduce the remaining acreage in the lease to less than 640 acres, except where a departure is occasioned by an irregular subdivision in which case the remaining leased acreage may be less than 640 acres by an amount which is smaller than the amount by which the area would be more than 640 acres if the irregular subdivision were added, and except that the minimum acreage provision of this section may be waived by the Secretary where he finds such exception is justified on the basis of exploratory and development data derived from activity on the leasehold. The relinquishment must: (1) Describe the lands to be relinquished as described in the lease; (2) include a statement as to whether the relinquished lands had been disturbed and if so whether they were restored as prescribed by the terms of the lease; (3) state whether wells had been drilled on the lands and if so whether they had been placed in condition for abandonment; and (4) furnish a statement that all moneys due and payable to workmen employed on the leased premises have been paid.

(b) A relinquishment shall take effect on the date it is filed, subject to the continued obligation of the lessee and his surety: (1) To make payments of all accrued rentals and royalties; (2) to place all wells on the land to be relinquished in condition for suspension of operations or abandonment; (3) to restore the surface resources in accordance with all regulations and the terms of the lease; and (4) to comply with all other environmental stipulations provided for by such regulations or lease. A statement must be furnished that all moneys due and payable to workmen employed on the leased premises have been paid.

§ 3244.2 Automatic terminations and reinstatements.

§ 3244.2–1 General.

Except as provided in § 3244.2–2 any lease will automatically terminate by operation of law if the lessee fails to pay the rental on or before the anniversary date of such lease. However, if the time for payment falls upon any day in which the proper office to receive payment is not open, payment received on the next official working day shall be deemed to be timely. The termination of the lease for failure to pay the rental must be noted on the official records of the proper BLM office. Upon such notation the lands included in such lease will become subject to leasing as provided for in Subpart 3211 of this chapter.

§ 3244.2–2 Exceptions.

(a) *Nominal deficiency.* If the rental payment due under a lease is paid on or before its anniversary date but the amount of the payment is deficient and the deficiency is nominal, the lease shall not have automatically terminated unless the lessee fails to pay the deficiency within the period prescribed in a Notice of Deficiency, or by the due date, whichever is later. A deficiency is nominal if it is not more than $10 or one percentum (1%) of the total payment due, whichever is more. The authorized officer shall send a Notice of Deficiency to the lessee on an approved form. The Notice shall be sent by certified mail, return receipt requested, and shall allow the lessee 15 days from the date of receipt to submit the full balance due to the proper BLM office. If the payment called for in the notice is not made within the time allowed, the lease will have terminated by operation of law as of its anniversary date.

(b) *Reinstatements.* (1) Except as hereinafter provided, the authorized officer may reinstate a lease which has terminated automatically for failure to pay the full amount of rental due on or before the anniversary date, if it is shown to his satisfaction that such failure was either justifiable or not due to a lack of reasonable diligence on the part of the lessee; and a petition for reinstatement, together with the required rental, including any back rental which has accrued from the date of termination of the lease, is filed with the proper BLM office.

(2) The burden of showing that the failure to pay on or before the anniversary date was justifiable or not due to lack of reasonable diligence will be on the lessee. Reasonable diligence normally requires sending or delivering payments sufficiently in advance of the anniversary date to account for normal delays in the collection, transmittal, and delivery of the payment. The authorized officer may require evidence, such as post office receipts, of the time of sending or delivery of payments.

(3) Under no conditions will a lease be reinstated if (i) a valid lease has been issued prior to the filing of a petition for reinstatement affecting any of the lands covered by the terminated lease, or (ii) the interest in the lands has been withdrawn, disposed of, or has otherwise become unavailable for leasing. However, the authorized officer will not issue a new lease for lands covered by a lease which terminated automatically until 90 days after the date of termination.

(4) Reinstatement of terminated leases is discretionary with the Secretary. The basic criterion in accordance with which this discretion will be exercised is whether the Secretary would be willing to issue a lease if a new lease offer for the same land were under consideration.

§ 3244.3 Cancellation of lease for noncompliance with regulations or lease terms; notice; hearing.

A lease may be canceled by the authorized officer for any violation of these regulations, the regulations in 30 CFR Part 270, or the lease terms, 30 days after receipt by the lessee of notice from the authorized officer of the violation, unless (a) the violation has been corrected, or (b) the violation is one that cannot be corrected within the notice period and the lessee has in good faith commenced within the notice period to correct the violation and thereafter proceeds diligently to complete the correction. A lessee shall be entitled to a hearing on the matter of any such claimed violation or proposed cancelation of lease if a request for a hearing is made to the authorized officer within the 30-day period after notice. The procedures with respect to notice of such hearing and the conduct thereof, and with respect to appeals from decisions of Administrative Law Judges upon such hearings, shall follow insofar as practicable the procedural rules applicable to hearings and appeals in public lands cases within the jurisdiction of the Board of Land Appeals, Office of Hearings and Appeals, contained in Department Hearings and Appeals Procedures, Part 4 of this title. The period for correction of violation or commencement to correct a violation of regulations or of lease terms, as aforesaid, shall be extended to 30 days after the lessee's receipt of the Administrative Law Judge's decision upon such a hearing if the Administrative Law Judge shall find that a violation exists.

§ 3244.4 Expiration by operation of law.

Any lease for land on which, or for which under an approved cooperative or unit plan of development or operation, there is no production in commercial quantities, or a producing well, or actual drilling operations being diligently prosecuted, will expire at the end of its primary term without notice to the lessee. Notation of such expiration need not be made on the official records, but the lands previously covered by that expired lease will be subject to the filing of new applications for leases only as provided in these regulations.

§ 3244.5 Removal of materials and supplies upon termination of lease.

Upon the expiration of the lease, or the earlier termination thereof pursuant to this subpart, the lessee shall have the privilege at any time within a period of ninety (90) days thereafter of removing from the premises any materials, tools, appliances, machinery, structures, and equipment other than improvements needed for producing wells. Any materials, tools, appliances, machinery, structures, and equipment subject to removal, but not removed within the 90-day period, or any extension thereof that may be granted because of adverse climatic conditions during that period, shall, at the option of the Supervisor, become property of the lessor, but the lessee shall remove any or all such property where so directed by the lessor.

NOTE: Forms 3200-4 and 3200-1 filed as part of the original document. Copies of these forms may be obtained by writing Geothermal Coordinator, Department of the Interior, Washington, D.C. 20240.

Dated: December 17, 1973.

W. W. LYONS,
Deputy Under Secretary of the Interior.

[FR Doc.73-26890 Filed 12-20-73;8:45 am]

GPO 851-608

APPENDIX B

Title 30—Mineral Resources

CHAPTER II—GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

PART 270—GEOTHERMAL RESOURCES OPERATIONS ON PUBLIC, ACQUIRED, AND WITHDRAWN LANDS

PART 271—GEOTHERMAL RESOURCES UNIT PLAN REGULATIONS (INCLUDING SUGGESTED FORMS)

The purpose of these regulations is to implement the Geothermal Steam Act of 1970 (30 U.S.C. 1001–1025) and provide for the leasing of the public and acquired lands of the United States for the purpose of geothermal resources exploration, development, and production.

The public was afforded an opportunity to comment on proposed rulemaking published on July 23, 1971, November 29, 1972, and July 23, 1973 and supplemented on August 8, 1973. These regulations reflect consideration of all comments received on the published proposed rulemaking.

A Final Environmental Statement, prepared in accordance with the provisions of section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C)), was issued on October 23, 1973. It discussed the environmental impact of leasing federally owned geothermal resources under the proposed rulemaking, and proposed provisions for inclusion in regulations and leases to mitigate any possible impacts on the environment.

These regulations will be effective January 1, 1974.

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GENERAL PROVISIONS

§ 270.1 Purpose and authority.

The Geothermal Steam Act enacted on December 24, 1970 (84 Stat. 1566) referred to in this part as "the Act", authorizes the Secretary of the Interior to prescribe rules and regulations applicable to operations conducted under a lease granted pursuant to that Act, and for the development and conservation of geothermal steam and associated geothermal resources, the prevention of waste, the protection of the public interest, and the protection of water quality, and other environmental qualities. The regulations in this part shall be administered by the Director through the Chief, Conservation Division, or his duly appointed representative.

§ 270.2 Definitions.

As used in the regulations in this part, the term:

(a) "Secretary" means the Secretary of the Interior or any person duly authorized to exercise the powers vested in that officer.

(b) "Director" means the Director of the Geological Survey.

(c) "Supervisor" means a representative of the Secretary, subject to the direction and supervisory authority of the Director, the Chief, Conservation Division, Geological Survey, and the appropriate Regional Conservation Manager, Conservation Division, Geological Survey, authorized and empowered to regulate operations and to perform other duties prescribed in the regulations in this part or any subordinate of such a representative acting under his direction.

(d) "Geothermal lease" means a lease issued under 43 CFR Group 3200.

(e) "Lessee" means the individual, corporation, association, or municipality to which a geothermal lease has been issued and its successor in interest or assignee. It also means any agent of the lessee or an operator holding authority by or through the lessee.

(f) "Operator" means the individual, corporation, or association having control or management of operations on the leased lands or a portion thereof. The operator may be the lessee, designated operator, or agent of the lessee, or holder of rights under an approved operating agreement.

(g) "Geothermal resources" means (1) all products of geothermal processes, embracing indigenous steam, hot water, and hot brines; (2) steam and other gases, hot water, and hot brines, resulting from water, gas, or other fluids artificially introduced into geothermal formations; (3) heat or other associated energy found in geothermal formations; and (4) any byproduct derived therefrom.

(h) "Byproduct" means (1) any mineral or minerals (exclusive of oil, hydrocarbon gas, and helium), which are found in solution or developed in association with geothermal steam and which have a value of less than 75 per centum of the value of the geothermal steam or are not, because of quantity, quality, or technical difficulties in extraction and production, of sufficient value to warrant extraction and production by themselves, and (2) commercially demineralized water.

(i) "Participating area" means that part of the unit area which is deemed to be productive from a horizon or deposit and to which production would be allocated in the manner described in the unit agreement assuming that all lands are committed to the unit agreement.

(j) "Waste" means (1) physical waste, as that term is generally understood; (2) waste of reservoir energy through inefficiency, improper use of or unnecessary dissipation of reservoir energy; (3) the location, spacing, drilling, equipping, operating, or producing of any geothermal well or wells in a manner which causes or tends to cause reduction in the quantity of geothermal energy ultimately recoverable from a reservoir under prudent and workmanlike operations or which tends to cause unnecessary or excessive surface or subsurface loss or destruction of geothermal energy; and (4) the inefficient transmission of geothermal energy from the source (wellhead) to point of utilization.

(k) "Directionally drilled well" means the deviation of a well bore from the vertical or from its normal course in an intended predetermined direction or course with respect to the points of the compass. Directionally drilled well shall not include a well deviated for the purpose of straightening a hole that has become crooked in the normal course of drilling or holes deviated at random without regard to compass direction in an attempt to sidetrack a portion of the hole on account of mechanical difficulty in drilling.

(l) "Geothermal resources operational order" or "GRO order" means a formal numbered order, issued by the Supervisor, with the prior approval of the Chief, Conservation Division, Geological Survey, which implements the regulations in this part and applies to operations in an area, region, or any significant portion thereof.

(m) "Producible well" means a well which is capable of producing geothermal resources in commercial quantities.

(n) "Commercial quantities" means quantities sufficient to provide a return after all variable costs of production have been met.

(o) "Area of operations" means that area of the leased lands which is required for exploration, development, and producing operations, and which is delineated on a map or plat which is made a part of the approved plan of operations. It encompasses the area generally needed for wells, flow lines, separators, surge tanks, drill pads, mud pits, workshops, and other such facilities used for on-project geothermal resources field exploration, development, and production operations.

JURISDICTION AND FUNCTIONS OF SUPERVISOR

§ 270.10 Jurisdiction.

Drilling and production operations, handling and measurement of production, determination and collection of royalty and, in general, all operations conducted on a geothermal lease are subject to the regulations in this part and the applicable regulations contained in 43 CFR Group 3200, and are under the jurisdiction of the Supervisor for the area in which the leased land is situated, subject to the supervisory authority of the Secretary and the Director.

§ 270.11 General functions.

The Supervisor is authorized and directed to carry out the provisions of this part. He will require compliance with the terms of geothermal leases, with the regulations in this part and the applicable regulations in 43 CFR Group 3200, and with the applicable statutes. He shall act on all applications, requests, and notices required in this part. In executing his functions under this part the Supervisor shall ensure that all operations, within the area of operations, will conform to the best practice and are conducted in such manner as to protect the deposits of the leased lands and to result in the maximum ultimate recovery of geothermal resources, with minimum waste, and are consistent with the principles of the use of the land for other purposes and of the protection of the environment. Inasmuch as conditions in one area may vary widely from conditions in another area, the regulations in this part are intended to be general in nature. Detailed procedures hereunder in any particular area

will be covered by GRO orders. The requirements to be set forth in GRO orders relating to surface resources or uses will be coordinated with the appropriate land management agency. The Supervisor may issue oral orders to govern lease operations, but such orders shall be confirmed in writing by the Supervisor as promptly as possible. The Supervisor may issue other orders and rules to govern the development and method for production of a deposit, field, or area. Prior to the issuance of GRO orders and other orders and rules and the approval of any plan of operations, the Supervisor shall, consult with, and receive comments from appropriate Federal and State agencies, lessees, operators, or interested parties. Before permitting other operations on the leased land, the Supervisor shall determine if the lease is in good standing, whether the lessee is authorized to conduct operations, has filed an acceptable bond, and has an approved plan of operations.

§ 270.12 Regulation of operations.

The Supervisor shall inspect and supervise operations performed under the regulations in this part to: (a) Prevent waste and damage to formations or deposits containing geothermal resources; (b) prevent unnecessary damage to other natural resources; (c) prevent degradation of the water quality; (d) protect air quality, water quality, and other environmental qualities; and (e) prevent injury to life or property. The Supervisor shall issue such GRO orders as are necessary to accomplish these purposes.

§ 270.13 Required samples, tests, and surveys.

When necessary or advisable, the Supervisor shall require that adequate samples be taken and tests or surveys be made using acceptable techniques, without cost to the lessor, to determine the identity and character of formations; the presence of geothermal resources, water, or reservoir energy; the quantity and quality of geothermal resources, water or reservoir energy; the amount and direction of deviation of any well from the vertical; formation, casing, and tubing pressures, temperatures, rate of heat and fluid flow, and whether operations are conducted in a manner looking to the protection of the interests of the lessor.

§ 270.14 Drilling and abandonment of wells.

The Supervisor shall require that drilling be conducted in accordance with the terms of the lease, GRO orders, and the regulations in this part and 43 CFR Group 3200; and shall require plugging and abandonment of any well or wells no longer necessary for operations in accordance with plans approved or prescribed by him. Upon the failure of a lessee to comply with any requirement under this section, the Supervisor is authorized to perform the work at the expense of the lessee and the surety.

§ 270.15 Well spacing and well casing.

The Supervisor shall approve proposed well-spacing and well-casing programs or prescribe such modifications to the programs as he determines necessary for proper development, giving consideration to such factors as: (a) Topographic characteristics of the area; (b) hydrologic, geologic and reservoir characteristics of the field; (c) the number of wells that can be economically drilled to provide the necessary volume of geothermal resources for the intended use; (d) protection of correlative rights; (e) minimizing well interference; (f) unreasonable interference with multiple use of lands; and (g) protection of the environment, including ground water quality.

§ 270.16 Values and payment for losses.

The Supervisor shall determine the value of production accruing to the lessor where there is loss through waste or failure to drill and produce protection wells on the lease, and the compensation due to the lessor as reimbursement for such loss. Payment for such losses will be paid when billed.

§ 270.17 Suspension of operations and production.

(a) On receipt of an application filed in accordance with 43 CFR 3205.3–8 for suspension of operations or production, or both, under a producing geothermal lease (or for relief from any drilling or producing requirements of such a lease), the Supervisor may, if he deems the suspension or relief warranted, approve the application.

(b) In the interest of conservation, the Supervisor may, on his own motion, suspend operations or production, or both, on any geothermal lease.

(c) Where operations or production, or both, under a lease, have been suspended, the Supervisor may approve resumption of operations or production either on his own motion or upon written request by the lessee or his agent.

(d) Whenever it appears from facts adduced by or furnished to the Supervisor that the interest of the lessor requires additional drilling or producing operations, he may, by written notice, order the beginning or resumption of such operations.

(e) See 43 CFR 3205.3–7 and 3205.3–8 for regulations concerning requests to waive, suspend, or reduce payments of rental or royalty, and extensions of leases on which operations or production have been suspended.

REQUIREMENTS FOR LESSEES (INCLUDING OPERATORS)

§ 270.30 Lease terms, regulations, waste, damage, and safety.

(a) The lessee shall comply with the lease terms, lease stipulations, applicable laws and regulations and any amendments thereof, GRO orders, and other written or oral orders of the Supervisor. All oral orders (to be confirmed in writing as provided in § 270.11) are effective when issued unless otherwise specified.

(b) The lessee shall take all reasonable precautions to prevent: (1) Waste; (2) damage to any natural resource including trees and other vegetation, fish and wildlife and their habitat; (3) injury or damage to persons, real or personal property; and (4) any environmental pollution or damage.

(c) Any significant effect on the environment created by the lessee's operations or failure to comply with environmental standards shall be reported to the Supervisor within 24 hours and confirmed in writing within 30 days.

§ 270.31 Designation of operator or agent.

In all cases where operations are not conducted by the lessee but are to be conducted under authority of an unapproved operating agreement, assignment or other arrangement, a "designation of operator" shall be submitted to the Supervisor, in a manner and form approved by him, prior to commencement of operations. Such a designation will be accepted as authority of the operator or his local representative to act for the lessee and to sign any papers or reports required under the regulations in this part. All changes of address and any termination of the authority of the operator shall be immediately reported, in writing, to the Supervisor.

§ 270.32 Local agent.

When required by the Supervisor, the lessee shall designate a local representative empowered to receive notices and comply with orders of the Supervisor issued pursuant to the regulations in this part.

§ 270.33 Drilling and producing obligations.

(a) The lessee shall diligently drill and produce such wells as are necessary to protect the lessor from loss by reason of production on other properties, or in lieu thereof, with the consent of the Supervisor, shall pay a sum determined by the Supervisor as adequate to compensate the lessor for failure to drill and produce any such well.

(b) The lessee shall promptly drill and produce such other wells as the Supervisor may require in order that the lease be developed and produced in accordance with good operating practices. (See 43 CFR 3204.5.)

§ 270.34 Plan of operation.

Prior to commencing any operations on the leased lands or on any lands covered by a unit or cooperative agreement, the lessee shall submit in triplicate and obtain the approval of the Supervisor and the appropriate land management agency of a plan of operation for the area. Such plan shall include:

(a) The proposed location of each well including a layout showing the position of the mud tanks, reserve pits, cooling towers, pipe racks, etc.;

(b) Existing and planned access and lateral roads;

(c) Location and source of water supply and road building material;

(d) Location of camp sites, air-strips, and other supporting facilities;

(e) Other areas of potential surface disturbance;

(f) The topographic features of the land and the drainage patterns;

(g) Methods for disposing of waste material;

(h) A narrative statement describing the proposed measures to be taken for protection of the environment, including, but not limited to, the prevention or control of (1) fires, (2) soil erosion, (3) pollution of the surface and ground water, (4) damage to fish and wildlife or other natural resources, (5) air and noise pollution, and (6) hazards to public health and safety during lease activities;

(i) All pertinent information or data which the Supervisor may require to support the plan of operations for the utilization of geothermal resources and the protection of the environment;

(j) Provisions for monitoring deemed necessary by the Supervisor to ensure compliance with these regulations for the operations under the plan; and

(k) A requirement for the collection of data concerning the existing air and water quality, noise, seismic and land subsidence activities, and ecological system of the leased lands covering a period of at least one year prior to the submission of a plan for production. The informations required for paragraphs (a) through (f) of this section may be shown on a map or maps available from State or Federal sources.

§ 270.35 Subsequent well operations.

After completion of all operations authorized under any previously approved notice or plan, the lessee shall not begin to redrill, repair, deepen, plug back, shoot, or plug and abandon any well, make casing tests, alter the casing or liner, stimulate production, change the method of recovering production, or use any formation or well for brine or fluid injection until he has submitted to the Supervisor in writing a new plan of operations and has received written approval from him. However, in an emergency a lessee may take action to prevent damage without receiving prior approval from the Supervisor, but in such cases the lessee shall report his action to the Supervisor as soon as possible.

§ 270.36 Well designations.

The lessee shall mark each derrick upon commencement of drilling operations and each producing or suspended well in a conspicuous place with his name or the name of the operator, the serial number of the lease, the number and location of the well. Whenever possible, the well location shall be described by section or tract, township, range, and by quarter-quarter section or lot. The lessee shall take all necessary means and precautions to preserve these markings.

§ 270.37 Well records.

(a) The lessee shall keep for each well at his field headquarters or at other locations conveniently available to the Supervisor, accurate and complete rec-

ords of all well operations including production, drilling, logging, directional well surveys, casing, perforation, safety devices, redrilling, deepening, repairing, cementing, alterations to casing, plugging, and abandoning. The records shall contain a description of any unusual malfunction, condition or problem; all the formations penetrated; the content and character of mineral deposits and water in each formation; thermal gradients, temperatures, pressures, analyses of geothermal waters, the kind, weight, size, grade, and setting depth of casing; and any other pertinent information.

(b) The lessee shall, within 30 days after completion of any well, transmit to the Supervisor copies of the records of all operations in a form prescribed by the Supervisor.

(c) Upon request of the Supervisor, the lessee will furnish (1) legible, exact copies of service company reports on cementing, perforating, acidizing, analyses of cores, electrical, and temperature logs, chemical analyses of steam and waters, or other similar services; (2) other reports and records of operations in the manner and form prescribed by the Supervisor.

§ 270.38 Samples, tests, and surveys.

(a) The lessee, when required by the Supervisor, will make adequate sampling, tests and/or surveys using acceptable techniques, to determine the presence, quantity, quality, and potential of geothermal resources, mineral deposits, or water; the amount and direction of deviation of any well from the vertical; and/or formation temperatures and pressures, casing, tubing, or other pressures and such other facts as the Supervisor may require. Such tests or surveys shall be made without cost to the lessor.

(b) The lessee shall, without cost to the lessor, take such formation samples or cores to determine the identity and character of any formation as are required and prescribed by the Supervisor.

§ 270.39 Directional survey.

The Supervisor may require an angular deviation and directional survey to be made of the finished hole of each directionally drilled well. The survey shall be made at the risk and expense of the lessee unless requested by an offset lessee, and then, at the risk and expense of the offset lessee. A copy of the survey shall be furnished the Supervisor.

§ 270.40 Well control.

The lessee or operator shall: (a) Take all necessary precautions to keep all wells under control at all times; (b) utilize trained and competent personnel; (c) utilize properly maintained equipment and materials; and (d) use operating practices which insure the safety of life and property. The selection of the types and weights of drilling fluids and provisions for controlling fluid temperatures, blowout preventers, and other surface control equipment and materials, casing and cementing programs, etc., to be used shall be based on sound engineering principles and shall take into account apparent geothermal gradients, depths and pressures of the various formations to be penetrated and other pertinent geologic and engineering data and information about the area.

§ 270.41 Pollution.

The lessee shall comply with all Federal and State standards with respect to the control of all forms of air, land, water, and noise pollution, including, but not limited to, the control of erosion and the disposal of liquid, solid, and gaseous wastes. The Supervisor may, in his discretion, establish additional and more stringent standards, and, if he does so, the lessee shall comply with those standards. Plans for disposal of well effluents must take into account effects on surface and subsurface waters, plants, fish and wildlife and their habitats, atmosphere, or any other effects which may cause or contribute to pollution, and such plans must be approved by the Supervisor before action is taken under them.

§ 270.42 Noise abatement.

The lessee shall minimize noise during exploration, development and production activities. Welfare of the operating personnel and the public must not be affected as a consequence of the noise created by the expanding gases. The method and degree of noise abatement shall be as approved by the Supervisor.

§ 270.43 Land subsidence and seismic activity.

In the event subsidence or seismic activity results from the production of geothermal resources, as determined by monitoring activities by the lessee or a government body, the lessee shall take such action as required by the lease or by the Supervisor.

§ 270.44 Pits and sumps.

The lessee shall provide and use pits and sumps of adequate capacity and design to retain all materials and fluids necessary to drilling, production, or other operations unless otherwise specified by the Supervisor. In no event shall the contents of a pit or sump be allowed to: (a) Contaminate streams, artificial canals or waterways, ground waters, lakes or rivers; (b) adversely affect environment, persons, plants, fish and wildlife and their habitats; or (c) damage the aesthetic values of the property or adjacent properties. When no longer needed, pits and sumps are to be filled and covered and the premises restored to a near natural state, as prescribed by the Supervisor.

§ 270.45 Well abandonment.

The lessee shall promptly plug and abandon any well on the leased land that is not used or useful. No well shall be abandoned until its lack of capacity for further profitable production of geothermal resources has been demonstrated to the satisfaction of the Supervisor. Before abandoning a producible well, the lessee shall submit to the Supervisor a

statement of reasons for abandonment and his detailed plans for carrying on the necessary work. The detailed plans shall provide for the preservation of fresh water aquifers and for the prevention of intrusion into such aquifers of saline or polluted waters. A producible well may be abandoned only after receipt of written approval by the Supervisor. No well shall be plugged and abandoned until the manner and method of plugging have been approved or prescribed by the Supervisor. Equipment shall be removed, and premises at the well site shall be restored as near as reasonably possible to its original condition immediately after plugging operations are completed on any well except as otherwise authorized by the Supervisor. Drilling equipment shall not be removed from any suspended drilling well without taking adequate measures to close the well and protect the subsurface resources.

§ 270.46 Accidents.

The lessee shall take all reasonable precautions to prevent accidents and shall notify the Supervisor within 24 hours of all accidents on the leased land, and shall submit a full report thereon within 15 days.

§ 270.47 Workmanlike operations.

The lessee shall carry on all operations and maintain the property at all times in a workmanlike manner, having due regard for the conservation of the property and the environment and for the health and safety of employees. The lessee shall remove from the property or store, in an orderly manner, all scrap or other materials not in use.

§ 270.48 Departure from orders.

The Supervisor may prescribe or approve either in writing or orally, with prompt written confirmation, variances from the requirements of GRO orders and other orders issued pursuant to these regulations, when such variances are necessary for the proper control of a well, conservation of natural resources, protection of human health and safety, property, or the environment. The Supervisor shall inform appropriate Federal and State agencies, of any action taken under this section.

§ 270.49 Sales contracts.

The lessee shall file with the Supervisor within 30 days after the effective date of the sales contract a copy of any contract for the disposal of geothermal resources from the lease.

§ 270.50 Royalty payments.

The lessee shall pay all royalties as due under the terms of the lease. Payments of royalties are due not later than the last day of the month following the month in which the resource is sold or utilized, and shall be by check, bank draft, or money order, drawn to the order of the United States Geological Survey.

MEASUREMENT OF PRODUCTION AND COMPUTATION OF ROYALTIES

§ 270.60 Measurement of geothermal resources.

The lessee shall measure or gauge all production in accordance with methods approved by the Supervisor. The quantity and quality of all production shall be determined in accordance with the standard practices, procedures, and specifications generally used in industry. All measuring equipment shall be tested periodically and, if found defective, the Supervisor will determine the quantity and quality of production from the best evidence available.

§ 270.61 Determination of content of byproducts.

The lessee shall periodically furnish the Supervisor the results of periodic tests showing the content of byproducts in the produced geothermal fluid and gases. Such tests shall be taken as specified by the Supervisor and by the method of testing approved by him.

§ 270.62 Value of geothermal production for computing royalties.

(a) The value of geothermal production from the leased premises for the purpose of computing royalties shall be the reasonable value of the energy and the byproducts attributable to the lease as determined by the Supervisor. In determining the reasonable value of the energy and the byproducts the Supervisor shall consider:

(1) The highest price paid for a majority of the production of like quality in the same field or area;

(2) The total consideration accruing to the lessee from any disposition of the geothermal production;

(3) The value of the geothermal production used by the lessee;

(4) The value and cost of alternate available energy sources and byproducts;

(5) The cost of exploration and production, exclusive of taxes;

(6) The economic value of the resource in terms of its ultimate utilization;

(7) Production agreements between producer and purchaser; and

(8) Any other matters which he may consider relevant.

(b) Under no circumstances shall the value of any geothermal production for the purposes of computing royalties be less than:

(1) The total consideration accruing to the lessee from the sale thereof in cases where geothermal resources are sold by the lessee to another party;

(2) That amount which is the value of the end product attributable to the geothermal resource produced from a particular lease where geothermal resources are not sold by the lessee before being utilized, but are instead directly used in manufacturing, power production, or other industrial activity; or

(3) When a part of the resource only is utilized by the lessee and the remainder sold, the sum of the value of the end product attributable to the geothermal resource and the sales price received for the geothermal resources

§ 270.63 Computation of royalties.

(a) The value of geothermal production from a particular lease as determined pursuant to § 270.62 hereof, shall be apportioned between geothermal steam, heat, and other forms of energy and the byproducts.

(b) The royalties payable shall be the sum of (1) the amount resulting from the multiplication of the value attributable to the geothermal steam, heat, and other forms of energy by the royalty rate set for such forms of geothermal energy in the lease and (2) the amount resulting from the multiplication of the value attributable to byproducts by the royalty rate for byproducts set in the lease.

§ 270.64 Commingling production.

The supervisor may authorize a lessee to commingle production from wells on his lease with production from other leases held by him or by other lessees subjects to such conditions as he may prescribe.

REPORTS TO BE MADE BY ALL LESSEES (INCLUDING OPERATORS)

§ 270.70 General requirements.

Information required to be submitted in accordance with the regulations in this part shall be furnished as directed by the Supervisor. Copies of forms can be obtained from the Supervisor and must be filed with that official within the time limit prescribed.

When forms or reports other than those referred to in the regulations in this part may be necessary, instructions for the filing of such forms or reports will be given by the Supervisor.

§ 270.71 Application for permit to drill, redrill, deepen, or plug-back.

(a) A permit to drill, redrill, deepen, or plug-back a well on Federal lands must be obtained from the Supervisor before the work is begun. The application for the permit, which shall be filed in triplicate with the Supervisor, shall state the location of the well in feet, and direction from the nearest section or tract lines as shown on the official plat of survey or protracted surveys; the altitude of the ground and derrick floor above sea level and how it was determined, and should be accompanied by a proposed plan of operations as required by these regulations.

(b) The proposed drilling and casing plan shall be outlined in detail under the heading "Details of Work" in the applications referred to herein, and shall describe the type of tools and equipment to be used, the proposed depth to which the well will be drilled, the estimated depths to the top of important markers, the estimated depths at which water, geothermal resources, or other mineral resources are expected, the proposed casing program (including the size and weight of casing), the depth at which each string is to be set, and the amount of cement and mud to be used, the drilling method and type of circulating media (water, mud, foam, air or combinations thereof), the type of blowout prevention equipment to be used, the proposed coring, logging, or other program (such as drilling time log and sample description) to be used to determine the formations penetrated and the proposed program for determining geothermal gradients and the sampling and analysis of geothermal resources.

(c) Each application shall be accompanied by a plat showing the surface and expected bottomhole locations and the distances from the nearest section or tract lines as shown on the official plat of survey or protracted surveys. The scale shall not be less than 2,000 feet to 1 inch.

(d) Each application should be accompanied by supporting structural and hydrologic information based on available geologic and geophysical data.

§ 270.72 Sundry notices and reports on wells.

(a) Any written notice of intention to do work or to change plans previously approved must be filed with the Supervisor in triplicate, unless otherwise directed, and must be approved by him before the work is begun. If, in case of emergency, any notice is given orally or by wire, and approval is obtained, the transaction shall be confirmed in writing. A subsequent report of the work performed must also be filed with the Supervisor.

(b) Casing test: Notice shall be given in advance to the Supervisor or his representative of the date and time when the operator expects to make a casing test. Later, by agreement, the exact time shall be fixed. In the event of casing failure during the test, the casing must be repaired or replaced or recemented as required by the Supervisor or his representative. The results of the test must be reported within 30 days after making a casing test. The report must describe the test completely and state the amount of mud and cement used, the lapse of time between running and cementing the casing and making the test, and the method of testing.

(c) Repairs or conditioning of well: Before the repairing or conditioning of a well, a notice setting forth in detail the plan of work must be filed with, and approved by, the Supervisor. A detailed report of the work accomplished and the methods employed, including all dates, and the results of such work must be filed within 30 days after completion of the repair work.

(d) Well stimulation: Before the lessee commences stimulation of a well by any means, a notice, setting forth in detail the plan of work, must be filed with and approved by the Supervisor. The notice shall name the type of stimulant and the amount to be used. A report showing the

amount of stimulant used and the production rate before and after stimulation must be filed within 30 days from completion of the work.

(e) Altering casing in a well: Notice of intention to run a liner or to alter the casing by pulling or perforating by any means must be filed with and approved by the Supervisor before the work is started. This notice shall set forth in detail the plan of work. A report must be filed within 30 days after completion of the work stating exactly what was done and the results obtained.

(f) Notice of intention to abandon well: Before abandonment work is begun on any well, whether a drilling well, geothermal resources well, water well, or so-called dry hole, notice of intention to abandon shall be filed with, and approved by, the Supervisor. The notice must be accompanied by a complete log, in duplicate, of the well to date, provided the complete log has not been filed previously, and must give a detailed statement of the proposed work, including such information as kind, location, and length of plugs (by depths), plans for mudding, cementing, shooting, testing, and removing casing, and any other pertinent information.

(g) Subsequent report of abandonment: After a well is abandoned or plugged, a subsequent record of work done must be filed with the Supervisor. This report shall be filed separately within 30 days after the work is done. The report shall give a detailed account of the manner in which the abandonment or plugging work was carried out, including the nature and quantities of materials used in plugging and the location and extent (by depths) of the plugs of different materials; records of any tests or measurements made, and of the amount, size, and location (by depths) of casing left in the well; and a detailed statement of the volume of mud fluid used, and the pressure attained in mudding. If an attempt was made to part any casing, a complete report of the methods used and results obtained must be included.

§ 270.73 Log and history of well.

The lessee shall furnish in duplicate to the Supervisor, not later than 30 days after the completion of each well, a complete and accurate log and history, in chronological order, of all operations conducted on the well. A log shall be compiled for geologic information from cores or formations samples and duplicate copies of such log shall be filed. Duplicate copies of all electric logs, temperature surveys, water and steam analyses, hydrologic or heat flow tests, or direction surveys, if run, shall be furnished.

§ 270.74 Monthly report of operations.

A report of operations for each lease must be made for each calendar month, beginning with the month in which drilling operations are initiated. The report must be filed in duplicate with the Supervisor on or before the last day of the month following the month for which the report is filed unless an extension of time for the filing of the report is granted by the Supervisor. The report shall disclose accurately all operations conducted on each well during the month, the status of operations on the last day of the month, and a general summary of the status of operations on the leased lands. The report must be submitted each month until the lease is terminated or until omission of the report is authorized by the Supervisor. The report shall show for each calendar month:

(a) The lease serial number or the unit or communitization agreement number which shall be inserted in the upper right corner;

(b) Each well listed separately by number, and its location by 40-acre subdivision (quarter-quarter section or lot), section number, township, range, and meridian;

(c) The number of days each well was produced, whether steam or hot water or both were produced, and the number of days each input well was in operation, if any;

(d) The quantity of production and any byproducts obtained from each well, if any are recovered;

(e) The depth of each active or suspended well, and the name, character, and depth of each formation drilled during the month, the date and reason for every shutdown, the names and depths of important formation changes, the amount and size of any casing run since the last report, the dates and results of any tests or environmental monitoring conducted, and any other noteworthy information on operations not specifically provided for in the form.

(f) The footnote must be completely filled out as required by the Supervisor. If no sales were made during the calendar month, the report must so state.

§ 270.75 Monthly report of sales and royalty.

A report of sales and royalty for each productive lease must be filed each month once sales of production are made even though sales may be intermittent, unless otherwise authorized by the Supervisor. Total volumes of geothermal resources produced and sold, the value of production, and the royalty due the lessor must be shown. If byproducts are being recovered, the same requirement shall be applicable. This report is due on or before the last day of the month following the month in which production was obtained and sold or utilized, together with the royalties due the United States. Payment or royalty is to be made pursuant to § 270.50 unless otherwise authorized by the Supervisor.

§ 270.76 Annual report of compliance with environmental protection requirements.

The lessee shall submit annually a report giving a full account of the actions taken to comply with the appropriate Federal and State regulations or requirements of the Supervisor pertaining to the protection of the surface and subsurface environment. This report shall include but is not limited to such matters as:

(a) Noise abatement;
(b) Water quality;
(c) Air quality;
(d) Erosion control;
(e) Subsidence and seismic activity;
(f) Rehabilitation activities;
(g) Waste disposal; and
(h) Environmental effects on flora and fauna.

§ 270.77 Annual report of expenditures for diligent exploration operations.

A report of expenditures for exploration operations conducted during a lease year must be submitted annually to the Supervisor in order that such expenditures may be considered for qualification as diligent exploration pursuant to 43 CFR 3203.5.

§ 270.78 Notice of intent and permit to conduct exploration operations other than drilling, see 43 CFR 3209.0–5 (a)).

(a) A permit to conduct exploration operations on the leased lands or on any lands covered by a unit or cooperative agreement must be obtained from the Supervisor before the work is begun. The form used for exploration operations conducted pursuant to 43 CFR 3209 will be acceptable.

(b) The notice of intent shall be filed in triplicate with the Supervisor and shall include:

(1) The name and address, including zip code, both of the person, association, or corporation for whom the operations will be conducted and of the person who will be in charge of the actual exploration activities;

(2) A statement that the signers agree that exploration operations will be conducted pursuant to the terms and conditions listed on the approved form;

(3) A brief description of the type of operations which will be undertaken;

(4) The approximate dates of the commencement and termination of exploration operations; and

(5) A plan of operation as required by § 270.34 covering paragraphs (a) through (h), of this section.

(c) The lessee shall, within 30 days after completion of such operations, furnish the Supervisor two copies of the records of the operation.

§ 270.79 Public inspection of records.

Geologic and geophysical interpretations, maps, and data required to be submitted under this part shall not be available for public inspection without the consent of the lessee so long as the lease remains in effect.

PROCEDURE IN CASE OF VIOLATION OF THE REGULATIONS OR LEASE TERMS

§ 270.80 Noncompliance with regulations or lease terms.

(a) Whenever a lessee or anyone acting under his authority fails to comply with the provisions of the regulations or lease terms, the Supervisor shall give the lessee notice to remedy any defaults or violations. Failure by the lessee to perform or commence the necessary remedial action pursuant to the notice may result in a shut down of operations and may result in referral of the matter to the authorized offices of the Bureau of Land Management for action pursuant to 43 CFR 3244.3.

(b) The Supervisor is authorized to shut down any operations which he determines are unsafe or are causing or can cause pollution.

APPEALS

§ 270.90 Appeals.

Appeals from final orders or decisions issued under the regulations in this part shall be made in the manner provided in 30 CFR Part 290.

PART 271—GEOTHERMAL RESOURCES UNIT PLAN REGULATIONS (INCLUDING SUGGESTED FORMS)

GENERAL PROVISIONS

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AUTHORITY: Section 18 of the Geothermal Steam Act of 1970 (84 Stat. 1566) (see 43 CFR Subpart 3244).

§ 271.1 Introduction.

The regulations in this part prescribe the procedure to be followed and the requirements to be met by holders of Federal geothermal leases (see § 271.2d) and their representatives who wish to unite with each other, or jointly or separately with others, in collectively adopting and operating under a cooperative or unit plan for the development of any geothermal resources pool, field, or like area, or any part thereof. Such agreements may be initiated by lessees, or where in the interest of conserving natural resources they are deemed necessary they may be required by the Director.

§ 271.2 Definitions.

The following terms, as used in this part or in any agreement approved under the regulations in this part, shall have the meanings here indicated unless otherwise defined in such agreement:

(a) *Unit agreement.* An agreement or plan of development and operation for the production and utilization of separately owned interests in the geothermal resources made subject thereto

as a single consolidated unit without regard to separate ownerships and which provides for the allocation of costs and benefits on a basis defined in the agreement or plan.

(b) *Cooperative agreement.* An agreement or plan of development and operations for the production and utilization of geothermal resources made subject thereto in which separate ownership units are independently operated without allocation of production.

(c) *Agreement.* For convenience, the term "agreement" as used in the regulations in this part refers to either a unit or a cooperative agreement as defined in paragraphs (a) and (b) of this section unless otherwise indicated.

(d *Geothermal lease.* A lease issued under the act of December 24, 1970 (84 Stat. 1566), pursuant to the leasing regulations contained in 43 CFR Part 3200, and, unless the context indicates otherwise, "lease" means a geothermal lease.

(e) *Unit area.* The area described in a unit agreement as constituting the land logically subject to development under such agreement.

(f) *Unitized land.* The part of a unit area committed to a unit agreement.

(g) *Unitized substances.* Deposits of geothermal resources recovered from unitized land by operation under and pursuant to a unit agreement.

(h) *Unit operator.* The person, association, partnership, corporation, or other business entity designated under a unit agreement to conduct operations on unitized land as specified in such agreement.

(i) *Participating area.* That part of the Unit Area which is deemed to be productive from a horizon or deposit and to which production would be allocated in the manner described in the unit agreement assuming that all lands are committed to the unit agreement.

(j) *Working interest.* The interest held in geothermal resources or in lands containing the same by virtue of a lease, operating agreement, fee title, or otherwise, under which, except as otherwise provided in a unit or cooperative agreement, the owner of such interest is vested with the right to explore for, develop, produce, and utilize such resources. The right delegated to the unit operator as such by the unit agreement is not to be regarded as a working interest.

(k) *Secretary.* The Secretary of the Interior or any person duly authorized to exercise powers vested in that officer.

(l) *Director.* The Director of the U.S. Geological Survey.

(m) *Supervisor.* A representative of the Secretary, subject to the direction and supervisory authority of the Director, the Chief, Conservation Division, Geological Survey, and the appropriate Regional Conservation Manager, Conservation Division, Geological Survey, authorized and empowered to regulate operations and to perform other duties prescribed in the regulations in this part or any subordinate of such representative acting under his direction.

§ 271.3 Designation of area.

An application for designation of an area as logically subject to development and/or operation under a unit or cooperative agreement may be filed, in triplicate, by any proponent of such an agreement through the Supervisor. Each copy of the application shall be accompanied by a map or diagram on a scale of not less than 1 inch to 1 mile, outlining the area sought to be designated under this section. The Federal, State, and privately owned land should be indicated on said map by distinctive symbols or colors and Federal geothermal leases and lease applications should be identified by serial number. Geological information, including the results of geophysical surveys, and such other information as may tend to show that unitization is necessary and advisable in the public interest should be furnished in triplicate. Geological and geophysical information and data so furnished will not be available for public inspection, as provided by 5 U.S.C. section 552(b), without the consent of the proponent. The application and supporting data will be considered by the Director and the applicant will be informed of the decision reached. The designation of an area, pursuant to an application filed under this section, shall not create an exclusive right to submit an executed agreement for such area, nor preclude the inclusion of such area or any part thereof in another unit area.

§ 271.4 Preliminary consideration of agreements.

The form of unit agreement set forth in § 271.12 is acceptable for use in unproved areas. The use of this form is not mandatory, but any proposed departure therefrom should be submitted with the application submitted under § 271.3 for preliminary consideration and for such revision as may be deemed necessary. In areas proposed for unitization in which a discovery of geothermal resources has been made, or where a cooperative agreement is contemplated, the proposed agreement should be submitted with the application submitted under § 271.3 for preliminary consideration and for such revision as may be deemed necessary. The proposed form of agreement should be submitted in triplicate and should be plainly marked to identify the proposed variances from the form of agreement set forth in § 271.12.

§ 271.5 State land.

Where State-owned land is to be included in the unit, approval of the agreement by appropriate State officials should be obtained prior to its submission to the Department for approval of the executed agreement. When authorized by the laws of the State in which the unitized land is situated, provisions may be made in the agreement accepting State law, to the extent that they are applicable to non-Federal unitized land.

§ 271.6 Qualifications of unit operator.

A unit operator must qualify as to citizenship in the same manner as those holding interests in geothermal leases issued under the Geothermal Steam Act of 1970. The unit operator may be an owner of a working interest in the unit area or such other party as may be selected by the owners of working interests and approved by the Supervisor. The unit operator shall execute an acceptance of the duties and obligations imposed by the agreement. No designation of, or change in, a unit operator will become effective unless and until approved by the Supervisor, and no such approval will be granted unless the unit operator is deemed qualified to fulfill the duties and obligations prescribed in the agreement.

§ 271.7 Parties to unit or cooperative agreement.

The owners of any rights, title, or interest in the geothermal resources deposits to be developed and operated under an agreement can be regarded as proper parties to a proposed agreement. All such owners must be invited to join as parties to the agreement. If any owner fails or refuses to join the agreement, the proponent of the agreement should declare this to the Supervisor and should submit evidence of efforts made to obtain joinder of such owner and the reasons for nonjoinder.

§ 271.8 Approval of an executed unit or cooperative agreement.

(a) A duly executed unit or cooperative agreement will be approved by the Secretary, or his duly authorized representative, upon a determination that such agreement is necessary or advisable in the public interest and is for the purpose of properly conserving the natural resources. Taking into account the environmental consequences of the action. Such approval will be incorporated in a certificate appended to the agreement. No such agreement will be approved unless at least one of the parties is a holder of a Federal lease embracing lands being committed to the agreement and unless the parties signatory to the agreement hold sufficient interests in the area to give effective control of operations therein.

(b) Where a duly executed agreement is submitted for Departmental approval, a minimum of six signed counterparts should be filed. The same number of counterparts should be filed for documents supplementing, modifying, or amending an agreement, including change of operator, designation of new operator, and notice of surrender, relinquishment, or termination.

(c) The address of each signatory party to the agreement should be inserted below the party's signature. Each signature should be attested by at least one witness, if not notarized. Corporate or other signatures made in a representative capacity must be accompanied by evidence of the authority of the signatories to act unless such evidence is already a matter of record in the United States Geological Survey. (The parties may execute any number of counterparts of the agreement with the same force and effect as if all parties signed the same document, or may execute a ratification or consent in a separate instrument with like force and effect.).

(d) Any modification of an approved agreement will require approval of the Secretary or his duly authorized representative under procedures similar to those cited in paragraph (a) of this section.

§ 271.9 Filing of papers and number of counterparts.

(a) All proposals and supporting papers, instruments, and documents submitted under this part should be filed with the Supervisor, unless otherwise provided in this part or otherwise instructed by the Director.

(b) Plans of development and operation, plans of further development and operation, and proposed participating areas and revisions thereof should be submitted in quadruplicate.

(c) Each application for approval of a participating area, or revision thereof, should be accompanied by three copies of a substantiating geologic and engineering report, structure contour map or maps, cross-section or other pertinent data.

(d) Other instruments or documents submitted for approval should be submitted for approval in sufficient number to permit the approving official to return at least one approved counterpart.

§ 271.10 Bonds.

In lieu of separate bonds required for each Federal lease committed to a unit agreement, the unit operator may furnish and maintain a collective corporate surety bond or a personal bond conditioned upon faithful performance of the duties and obligations of the agreement and the terms of the leases subject thereto. Personal bonds shall be accompanied by a deposit of negotiable Federal securities in a sum equal at their par value to the amount of the bond and by a proper conveyance to the Secretary of full authority to sell such securities in case of default in the performance of the obligations assumed. The liability under the bond shall be for such amount as the Supervisor shall determine to be adequate to protect the interests of the United States. Additional bond coverage may be required whenever deemed necessary by the Supervisor. The bond must be filed with and accepted by the Bureau of Land Management before operations will be approved. A form of corporate surety bond is set forth in § 271.15. In case of changes of unit operator, a new bond must be filed or a consent of surety to the change in principal under the existing bond must be furnished.

§ 271.11 Appeals.

Appeals from final orders or decisions issued under the regulations in this part shall be made in the manner provided in 30 CFR Part 290.

§ 271.12 Form of unit agreement for unproved areas.

UNIT AGREEMENT FOR THE DEVELOPMENT AND
OPERATION OF THE ____________ UNIT AREA
COUNTY OF ______________________________
STATE OF ________________________________

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__________________________ UNIT AGREEMENT
________________ COUNTY ________________

This Agreement entered into as of the ______ day of ____________, 19__, by and between the parties subscribing, ratifying, or consenting hereto, and herein referred to as the "parties hereto".

WITNESSETH: Whereas the parties hereto are the owners of working, royalty, or other geothermal resources interests in land subject to this Agreement; and

Whereas the Geothermal Steam Act of 1970 (84 Stat. 1566), hereinafter referred to as the "Act", authorizes Federal lessees and their representatives to unite with each other, or jointly or separately with others, in collectively adopting and operating under a cooperative or unit plan of development or operation of any geothermal resources pool, field, or like area, or any part thereof, for the purpose of more properly conserving the natural resources thereof, whenever determined and certified by the Secretary of the Interior to be necessary or advisable in the public interest; and

Whereas the parties hereto hold sufficient interest in the ____________ Unit Area covering the land herein described to effectively control operations therein; and

Whereas, it is the purpose of the parties hereto to conserve natural resources, prevent waste, and secure other benefits obtainable through development and operations of the area subject to this Agreement under the terms, conditions, and limitations herein set forth;

Now, therefore, in consideration of the premises and the promises herein contained, the parties hereto commit to this agreement their respective interests in the below-defined Unit Area, and agree severally among themselves as follows:

ARTICLE I—ENABLING ACT AND REGULATIONS

1.1 The Act and all valid pertinent regulations, including operating and unit plan regulations, heretofore or hereafter issued thereunder are accepted and made a part of this agreement as to Federal lands.

1.2 As to non-Federal lands, the geothermal resources operating regulations in effect as of the effective date hereof governing drilling and producing operations, not inconsistent with the laws of the State in which the non-Federal land is located, are hereby accepted and made a part of this agreement.

ARTICLE II—DEFINITIONS

2.1 The following terms shall have the meanings here indicated:

(a) *Geothermal lease.* A lease issued under the act of December 24, 1970 (84 Stat. 1566), pursuant to the leasing regulations contained in 43 CFR Group 3200 and, unless the context indicates otherwise, "lease" shall mean a geothermal lease.

(b) *Unit area.* The area described in Article III of this Agreement.

(c) *Unit Operator.* The person, association, partnership, corporation, or other business entity designated under this Agreement to conduct operations on Unitized Land as specified herein.

(d) *Participating area.* That part of the Unit Area which is deemed to be productive from a horizon or deposit and to which production would be allocated in the manner described in the unit agreement assuming that all lands are committed to the unit agreement.

(e) *Working interest.* The interest held in geothermal resources or in lands containing the same by virtue of a lease, operating agreement, fee title, or otherwise, under which, except as otherwise provided in this Agreement, the owner of such interest is vested with the right to explore for, develop, produce and utilize such resources. The right delegated to the Unit Operator as such by this Agreement is not to be regarded as a Working Interest.

(f) *Secretary.* The Secretary of the Interior or any person duly authorized to exercise powers vested in that officer.

(g) *Director.* The Director of the U.S. Geological Survey.

(h) *Supervisor.* A representative of the Secretary, subject to the direction and supervisory authority of the Director, the Chief, Conservation Division, Geological Survey, and the appropriate Regional Conservation Manager, Conservation Division, Geological Survey, authorized and empowered to regulate operations and to perform other duties prescribed in the regulations in this part or any subordinate of such representative acting under his direction.

ARTICLE III—UNIT AREA AND EXHIBITS

3.1 The area specified on the map attached hereto marked "Exhibit A" is hereby designated and recognized as constituting the Unit Area, containing ____________ acres, more or less.

The above-described Unit Area shall when practicable be expanded to include therein any additional lands or shall be contracted to exclude lands whenever such expansion or contraction is deemed to be necessary or advisable to conform with the purposes of this Agreement.

3.2 Exhibit A attached hereto and made a part hereof is a map showing the boundary

of the Unit Area, the boundaries and identity of tracts and leases in said area to the extent known to the Unit Operator.

3.3 Exhibit B attached hereto and made a part hereof is a schedule showing to the extent known to the Unit Operator the acreage, percentage, and kind of ownership of geothermal resources interests in all lands in the Unit Area.

3.4 Exhibits A and B shall be revised by the Unit Operator whenever changes in the Unit Area render such revision necessary, or when requested by the Supervisor, and not less than five copies of the revised Exhibits shall be filed with the Supervisor.

ARTICLE IV—CONTRACTION AND EXPANSION OF UNIT AREA

4.1 Unless otherwise specified herein, the expansion and/or contraction of the Unit Area contemplated in Article 3.1 hereof shall be effected in the following manner:

(a) Unit Operator either on demand of the Director or on its own motion and after prior concurrence by the Director, shall prepare a notice of proposed expansion or contraction describing the contemplated changes in the boundaries of the Unit Area, the reasons therefore, and the proposed effective date thereof, preferably the first day of a month subsequent to the date of notice.

(b) Said notice shall be delivered to the Supervisor, and copies thereof mailed to the last known address of each Working Interest Owner, Lessee, and Lessor whose interests are affected, advising that 30 days will be allowed for submission to the Unit Operator of any objections.

(c) Upon expiration of the 30-day period provided in the preceding item (b) hereof, Unit Operator shall file with the Supervisor evidence of mailing of the notice of expansion or contraction and a copy of any objections thereto which have been filed with the Unit Operator, together with an application in sufficient number, for approval of such expansion or contraction and with appropriate joinders.

(d) After due consideration of all pertinent information, the expansion or contraction shall, upon approval by the Supervisor, become effective as of the date prescribed in the notice thereof.

4.2 Unitized Leases, insofar as they cover any lands which are excluded from the Unit Area under any of the provisions of this Article IV may be maintained and continued in force and effect in accordance with the terms, provisions, and conditions contained in the Act, and the lease or leases and amendments thereto, except that operations and/or production under this Unit Agreement shall not serve to maintain or continue the excluded portion of any lease.

4.3 All legal subdivisions of unitized lands (i.e., 40 acres by Governmental survey or its nearest lot or tract equivalent in instances of irregular surveys), no part of which is entitled to be within a Participating Area on the fifth anniversary of the effective date of the initial Participating Area established under this Agreement, shall be eliminated automatically from this Agreement effective as of said fifth anniversary and such lands shall no longer be a part of the Unit Area and shall no longer be subject to this Agreement unless diligent drilling operations are in progress on an exploratory well on said fifth anniversary, in which event such lands shall not be eliminated from the Unit Area for as long as exploratory drilling operations are continued diligently with not more than four (4) months time elapsing between the completion of one exploratory well and the commencement of the next exploratory well.

4.4 An exploratory well, for the purposes of this Article IV is defined as any well, regardless of surface location, projected for completion in a zone or deposit below any zone or deposit for which a Participating Area has been established and is in effect, or any well, regardless of surface location, projected for completion at a subsurface location under Unitized Lands not entitled to be within a Participating Area.

4.5 In the event an exploratory well is completed during the four (4) months immediately preceding the fifth anniversary of the initial Participating Area established under this Agreement, lands not entitled to be within a Participating Area shall not be eliminated from this Agreement on said fifth anniversary, provided the drilling of another exploratory well is commenced under an approved Plan of Operation within four (4) months after the completion of said well. In such event, the land not entitled to be in participation shall not be eliminated from the Unit Area so long as exploratory drilling operations are continued diligently with not more than four (4) months time elapsing between the completion of one exploratory well and the commencement of the next exploratory well.

4.6 With prior approval of the Supervisor, a period of time in excess of four (4) months may be allowed to elapse between the completion of one well and the commencement of the next well without the automatic elimination of nonparticipating acreage.

4.7 Unitized lands proved productive by drilling operations which serve to delay automatic elimination of lands under this Article IV shall be incorporated into a Participating Area (or Areas) in the same manner as such lands would have been incorporated in such areas had such lands been proven productive during the year preceding said fifth anniversary.

4.8 In the event nonparticipating lands are retained under this Agreement after the fifth anniversary of the initial Participating Area as a result of exploratory drilling operations, all legal subdivisions of unitized land (i.e., 40 acres by Government survey or its nearest lot or tract equivalent in instances of irregular Surveys), no part of which is entitled to be within a Participating Area shall be eliminated automatically as of the 121 day, or such later date as may be established by the Supervisor, following the completion of the last well recognized as delaying such automatic elimination beyond the fifth anniversary of the initial Participating Area established under this Agreement.

ARTICLE V—UNITIZED LAND AND UNITIZED SUBSTANCES

5.1 All land committed to this Agreement shall constitute land referred to herein as "Unitized Land". All geothermal resources in and produced from any and all formations of the Unitized Land are unitized under the terms of this agreement and herein are called "Unitized Substances."

ARTICLE VI—UNIT OPERATOR

6.1 ____________ is hereby designated as Unit Operator and by signature hereto as Unit Operator agrees and consents to accept the duties and obligations of Unit Operator for the discovery, development, production, distribution and utilization of Unitized Substances as herein provided. Whenever reference is made herein to the Unit Operator, such reference means the Unit Operator acting in that capacity and not as an owner of interest in Unitized Substances, and the term "Working Interest Owner" when used herein shall include or refer to Unit Operator as the owner of a Working Interest when such an interest is owned by it.

ARTICLE VII—RESIGNATION OR REMOVAL OF UNIT OPERATOR

7.1 Prior to the establishment of a Participating Area, hereunder, Unit Operator

shall have the right to resign. Such resignation shall not become effective so as to release Unit Operator from the duties and obligations of Unit Operator or terminate Unit Operators rights, as such, for a period of six (6) months after notice of its intention to resign has been served by Unit Operator on all Working Interest Owners and the Supervisor, nor until all wells then drilled hereunder are placed in a satisfactory condition for suspension or abandonment whichever is required by the Supervisor, unless a new Unit Operator shall have been selected and approved and shall have taken over and assumed the duties and obligations of Unit Operator prior to the expiration of said period.

7.2 After the establishment of a Participating Area hereunder Unit Operator shall have the right to resign in the manner and subject to the limitations provided in 7.1 above.

7.3 The Unit Operator may, upon default or failure in the performance of its duties or obligations hereunder, be subject to removal by the same percentage vote of the owners of Working Interests as herein provided for the selection of a new Unit Operator. Such removal shall be effective upon notice thereof to the Supervisor.

7.4 The resignation or removal of Unit Operator under this Agreement shall not terminate its right, title, or interest as the owner of a Working Interest or other interest in Unitized Substances, but upon the resignation or removal of Unit Operator becoming effective, such Unit Operator shall deliver possession of all wells, equipment, material, and appurtenances used in conducting the unit operations to the new duly qualified successor Unit Operator or, if no such new unit operator is elected, to the common agent appointed to represent the Working Interest Owners in any action taken hereunder to be used for the purpose of conducting operations hereunder.

7.5 In all instances of resignation or removal, until a successor Unit Operator is selected and approved as hereinafter provided, the Working Interest Owners shall be jointly responsible for performance of the duties and obligations of Unit Operator, and shall not later than 30 days before such resignation or removal becomes effective appoint a common agent to represent them in any action to be taken hereunder.

7.6 The resignation of Unit Operator shall not release Unit Operator from any liability for any default by it hereunder occurring prior to the effective date of its resignation.

ARTICLE VIII—SUCCESSOR UNIT OPERATOR

8.1 If, prior to the establishment of a Participating Area hereunder, the Unit Operator shall resign as Operator, or shall be removed as provided in Article VII, a successor Unit Operator may be selected by vote of the owners of a majority of the Working Interests in Unitized Substances, based on their respective shares, on an acreage basis, in the Unitized Land.

8.2 If, after the establishment of a Participating Area hereunder, the Unit Operator shall resign as Unit Operator, or shall be removed as provided in Article VII, a successor Unit Operator may be selected by vote of the owners of a majority of the Working Interests in Unitized Substances, based on their respective shares, on a participating acreage basis. Provided, that, if a majority but less than 60 percent of the Working Interest in the Participating Lands is owned by the party to this agreement, a concurring vote of one or more additional Working Interest Owners owning 10 percent or more of the Working Interest in the participating land shall be required to select a new Unit Operator.

8.3 The selection of a successor Unit Operator shall not become effective until

(a) The Unit Operator so selected shall accept in writing the duties, obligations and responsibilities of the Unit Operator, and

(b) The selection shall have been approved by the Supervisor.

8.4 If no successor Unit Operator is selected and qualified as herein provided, the Director at his election may declare this Agreement terminated.

ARTICLE IX—ACCOUNTING PROVISIONS AND UNIT OPERATING AGREEMENT

9.1 Costs and expenses incurred by Unit Operator in conducting unit operations hereunder shall be paid and apportioned among and borne by the owners of Working Interests; all in accordance with the agreement or agreements entered into by and between the Unit Operator and the owners of Working Interests, whether one or more, separately or collectively.

9.2 Any agreement or agreements entered into between the Working Interest Owners and the Unit Operator as provided in this Article, whether one or more, are herein referred to as the "Unit Operating Agreement".

9.3 The Unit Operating Agreement shall provide the manner in which the Working Interest Owners shall be entitled to receive their respective share of the benefits accruing hereto in conformity with their underlying operating agreements, leases, or other contracts, and such other rights and obligations, as between Unit Operator and the Working Interest Owners.

9.4 Neither the Unit Operating Agreement nor any amendment thereto shall be deemed either to modify any of the terms and conditions of this Agreement or to relieve the Unit Operator of any right or obligation established under this Agreement.

9.5 In case of any inconsistency or conflict between this Agreement and the Unit Operating Agreement, this Agreement shall govern.

9.6 Three true copies of any Unit Operating Agreement executed pursuant to this Article IX shall be filed with the Supervisor prior to approval of this Agreement.

ARTICLE X—RIGHTS AND OBLIGATIONS OF UNIT OPERATOR

10.1 The right, privilege, and duty of exercising any and all rights of the parties hereto which are necessary or convenient for prospecting, producing, distributing or utilizing Unitized Substances are hereby delegated to and shall be exercised by the Unit Operator as provided in this Agreement in accordance with a Plan of Operations approved by the Supervisor.

10.2 Upon request by Unit Operator, acceptable evidence of title to geothermal resources interests in the Unitized Land shall be deposited with the Unit Operator, and together with this Agreement shall constitute and define the rights, privileges, and obligations of Unit Operator.

10.3 Nothing in this Agreement shall be construed to transfer title to any land or to any lease or operating agreement, it being understood that the Unit Operator, in its capacity as Unit Operator shall exercise the rights of possession and use vested in the parties hereto only for the purposes specified in this Agreement.

10.4 The Unit Operator shall take such measures as the Supervisor deems appropriate and adequate to prevent drainage of Unitized Substances from Unitized Land by wells on land not subject to this Agreement.

10.5 The Director is hereby vested with authority to alter or modify from time to time, in his discretion, the rate of prospecting and development and the quantity and rate of production under this Agreement.

ARTICLE XI—PLAN OF OPERATION

11.1 Concurrently with the submission of this Agreement for approval, Unit Operator

shall submit an acceptable Initial Plan of Operation. Said plan shall be as complete and adequate as the Supervisor may determine to be necessary for timely exploration and/or development and to insure proper protection of the environment and conservation of the natural resources of the Unit Area.

11.2 Prior to the expiration of the Initial Plan of Operation, or any subsequent Plan of Operation, Unit Operator shall submit for approval of the Supervisor an acceptable subsequent Plan of Operation for the Unit Area which, when approved by the Supervisor, shall constitute the exploratory and/or development drilling and operating obligations of Unit Operators under this Agreement for the period specified therein.

11.3 Any plan of Operation submitted hereunder shall

(a) Specify the number and locations of any wells to be drilled and the proposed order and time for such drilling, and

(b) To the extent practicable, specify the operating practices regarded as necessary and advisable for proper conservation of natural resources and protection of the environment in compliance with section 1.1.

11.4 The Plan of Operation submitted concurrently with this Agreement for approval shall prescribe that within six (6) months after the effective date hereof, the Unit Operator shall begin to drill an adequate test well at a location approved by the Supervisor, unless on such effective date a well is being drilled conformably with the terms, hereof, and thereafter continue such drilling diligently until the ________ formation has been tested or until at a lesser depth unitized substances shall be discovered which can be produced in paying quantities (i.e., quantities sufficient to repay the costs of drilling, completing, and producing operations, with a reasonable profit) or the Unit Operator shall at any time establish to the satisfaction of the Supervisor that further drilling of said well would be unwarranted or impracticable, provided, however, that Unit Operator shall not in any event be required to drill said well to a depth in excess of ________ feet.

11.5 The initial Plan of Operation and/or subsequent Plans of Operation submitted under this article shall provide that the Unit Operator shall initiate a continuous drilling program providing for drilling of no less than one well at a time, and allowing no more than six (6) months time to elapse between completion of one well and the beginning of the next well, until a well capable of producing Unitized Substances in paying quantities is completed to the satisfaction of the Supervisor or until it is reasonably proved that the Unitized Land is incapable of producing Unitized Substances in paying quantities in the formations drilled under this Agreement.

11.6 When warranted by unforeseen circumstances, the Supervisor may grant a single extension of any or all of the critical dates for exploratory drilling operations cited in the initial or subsequent Plans of Operation. No such extension shall exceed a period of four (4) months for each well, required by the Initial Plan of Operation.

11.7 Until there is actual production of Unitized Substances, the failure of Unit Operator to timely drill any of the wells provided for in Plans of Operation required under this Article XI or to timely submit an acceptable subsequent Plan of Operations, shall, after notice of default or notice of prospective default to Unit Operator by the Supervisor and after failure of Unit Operator to remedy any actual default within a reasonable time (as determined by the Supervisor), result in automatic termination of this Agreement effective as of the date of the default, as determined by the Supervisor.

11.8 Separate Plans of Operations may be submitted for separate productive zones, subject to the approval of the Supervisor. Also subject to the approval of the Supervisor, Plans of Operation shall be modified or supplemented when necessary to meet changes in conditions or to protect the interest of all parties to this Agreement.

ARTICLE XII—PARTICIPATING AREAS

12.1 Prior to the commencement of production of Unitized Substances, the Unit Operator shall submit for approval by the Supervisor a schedule (or schedules) of all land then regarded as reasonably proved to be productive from a pool or deposit discovered or developed; all lands in said schedule (or schedules), on approval of the Supervisor, will constitute a Participating Area (or Areas) effective as of the date production commences or the effective date of this Unit Agreement, whichever is later. Said schedule (or schedules) shall also set forth the percentage of Unitized Substances to be allocated, as herein provided, to each tract in the Participating Area (or Areas) so established and shall govern the allocation of production commencing with the effective date of the Participating Area.

12.2 A separate Participating Area shall be established for each separate pool or deposit of Unitized Substances or for any group thereof which is produced as a single pool or deposit and any two or more Participating Areas so established may be combined into one, on approval of the Supervisor. The effective date of any Participating Area established after the commencement of actual production of Unitized Substances shall be the first of the month in which is obtained the knowledge or information on which the establishment of said Participating Area is based, unless a more appropriate effective date is proposed by the Unit Operator and approved by the Supervisor.

12.3 Any Participating Area (or Areas) established under 12.1 or 12.2 above shall, subject to the approval of the Supervisor, be revised from time to time to include additional land then regarded as reasonably proved to be productive from the pool or deposit for which the Participating Area was established or to include lands necessary to unit operations, or to exclude land then regarded as reasonably proved not to be productive from the pool or deposit for which the Participating Area was established or to exclude land not necessary to unit operations and the schedule (or schedules) of allocation percentages shall be revised accordingly.

12.4 Subject to the limitation cited in 12.1 hereof, the effective date of any revision of a Participating Area established under Articles 12.1 or 12.2 shall be the first of the month in which is obtained the knowledge or information on which such revision is predicated, provided, however, that a more appropriate effective date may be used if justified by the Unit Operator and approved by the Supervisor.

12.5 No land shall be excluded from a Participating Area on account of depletion of the Unitized Substances, except that any Participating Area established under the provisions of this Article XII shall terminate automatically whenever all operations are abandoned in the pool or deposit for which the Participating Area was established.

12.6 Nothing herein contained shall be construed as requiring any retroactive adjustment for production obtained prior to the effective date of the revision of a Participating Area.

ARTICLE XIII—ALLOCATION OF UNITIZED SUBSTANCES

13.1 All Unitized Substances produced from a Participating Area, established under this Agreement, shall be deemed to be produced equally on an acreage basis from the several tracts of Unitized Land within the

Participating Area established for such production.

13.2 For the purpose of determining any benefits accruing under this Agreement, each Tract of Unitized Land shall have allocated to it such percentage of said production as the number of acres in the Tract included in the Participating Area bears to the total number of acres of Unitized Land in said Participating Area.

13.3 Allocation of production hereunder for purposes other than for settlement of the royalty obligations of the respective Working Interest Owners, shall be on the basis prescribed in the Unit Operating Agreement whether in conformity with the basis of allocation set forth above or otherwise.

13.4 The Unitized Substances produced from a Participating Area shall be allocated as provided herein regardless of whether any wells are drilled on any particular part or tract of said Participating Area.

ARTICLE XIV—RELINQUISHMENT OF LEASES

14.1 Pursuant to the provisions of the Federal leases and 43 CFR 3244.1, a lessee of record shall, subject to the provisions of the Unit Operating Agreement, have the right to relinquish any of its interests in leases committed hereto, in whole or in part; provided, that no relinquishment shall be made of interests in land within a Participating Area without the prior approval of the Director.

14.2 A Working Interest Owner may exercise the right to surrender, when such right is vested in it by any non-Federal lease, sublease, or operating agreement, provided that each party who will or might acquire the Working Interest in such lease by such surrender or by forfeiture is bound by the terms of this Agreement, and further provided that no relinquishment shall be made of such land within a Participating Area without the prior written consent of the non-Federal Lessor.

14.3 If as the result of relinquishment, surrender, or forfeiture the Working Interests become vested in the fee owner or lessor of the Unitized Substances, such owner may:

(1) Accept those Working Interest rights and obligations subject to this Agreement and the Unit Operating Agreement; or

(2) Lease the portion of such land as is included in a Participating Area established hereunder, subject to this Agreement and the Unit Operating Agreement; and provide for the independent operation of any part of such land that is not then included within a Participating Area established hereunder.

14.4 If the fee owner or lessor of the Unitized Substances does not, (1) accept the Working Interest rights and obligations subject to this Agreement and the Unit Operating Agreement, or (2) lease such lands as provided in 14.3 above within six (6) months after the relinquished, surrendered, or forfeited Working Interest becomes vested in said fee owner or lessor, the Working Interest benefits and obligations accruing to such land under this Agreement and the Unit Operating Agreement shall be shared by the owners of the remaining unitized Working Interests in accordance with their respective Working Interest ownerships, and such owners of Working Interests shall compensate the fee owner or lessor of Unitized Substances in such lands by paying sums equal to the rentals, minimum royalties, and royalties applicable to such lands under the lease or leases in effect when the Working Interests were relinquished, surrendered, or forfeited.

14.5 Subject to the provisions of 14.4 above, an appropriate accounting and settlement shall be made for all benefits accruing to or payments and expenditures made or incurred on behalf of any surrendered or forfeited Working Interest subsequent to the date of surrender or forfeiture, and payment of any moneys found to be owing by such an accounting shall be made as between the parties within thirty (30) days.

14.6 In the event no Unit Operating Agreement is in existence and a mutually acceptable agreement cannot be consummated between the proper parties, the Supervisor may prescribe such reasonable and equitable conditions of agreement as he deems warranted under the circumstances.

14.7 The exercise of any right vested in a Working Interest Owner to reassign such Working Interest to the party from whom obtained shall be subject to the same conditions as set forth in this Article XIV in regard to the exercise of a right to surrender.

ARTICLE XV—RENTALS AND MINIMUM ROYALTIES

15.1 Any unitized lease on non-Federal land containing provisions which would terminate such lease unless drilling operations are commenced upon the land covered thereby within the time therein specified or rentals are paid for the privilege of deferring such drilling operations, the rentals required thereby shall, notwithstanding any other provisions of this Agreement, be deemed to accrue as to the portion of the lease not included within a Participating Area and become payable during the term thereof as extended by this Agreement, and until the required drillings are commenced upon the land covered thereby.

15.2 Rentals are payable on Federal leases on or before the anniversary date of each lease year; minimum royalties accrue from the anniversary date of each lease year and are payable at the end of the lease year.

15.3 Beginning with the lease year commencing on or after ____________ and for each lease year thereafter, rental or minimum royalty for lands of the United States subject to this Agreement shall be made on the following basis:

(a) An advance annual rental in the amount prescribed in unitized Federal leases, in no event creditable against production royalties, shall be paid for each acre or fraction thereof which is not within a Participating Area.

(b) A minimum royalty shall be charged at the beginning of each lease year (such minimum royalty to be due as of the last day of the lease year and payable within thirty (30) days thereafter) of $2 an acre or fraction thereof, for all Unitized Acreage within a Participating Area as of the beginning of the lease year. If there is production during the lease year the deficit, if any, between the actual royalty paid and the minimum royalty prescribed herein shall be paid.

15.4 Rental or minimum royalties due on leases committed hereto shall be paid by Working Interest Owners responsible therefor under existing contracts, laws, and regulations, or by the Unit Operator.

15.5 Settlement for royalty interest shall be made by Working Interest Owners responsible therefor under existing contracts, laws, and regulations, or by the Unit Operator, on or before the last day of each month for Unitized Substances produced during the preceding calendar month.

15.6 Royalty due the United States shall be computed as provided in the operating regulations and paid in value as to all Unitized Substances on the basis of the amounts thereof allocated to unitized Federal land as provided herein at the royalty rate or rates specified in the respective Federal leases.

15.7 Nothing herein contained shall operate to relieve the lessees of any land from their respective lease obligations for the payment of any rental, minimum royalty, or royalty due under their leases.

ARTICLE XVI—OPERATIONS ON NONPARTICIPATING LAND

16.1 Any party hereto owning or controlling the Working Interest in any Unitized Land having thereon a regular well location may, with the approval of the Supervisor and at such party's sole risk, costs, and expense, drill a well to test any formation or deposit for which a Participating Area has not been established or to test any formation or deposit for which a Participating Area has been established if such location is not within said Participating Area, unless within 30 days of receipt of notice from said party of his intention to drill the well, the Unit Operator elects and commences to drill such a well in like manner as other wells are drilled by the Unit Operator under this Agreement.

16.2 If any well drilled by a Working Interest Owner other than the Unit Operator proves that the land upon which said well is situated may properly be included in a Participating Area, such Participating Area shall be established or enlarged as provided in this Agreement and the well shall thereafter be operated by the Unit Operator in accordance with the terms of this Agreement and the Unit Operating Agreement.

ARTICLE XVII—LEASES AND CONTRACTS CONFORMED AND EXTENDED

17.1 The terms, conditions, and provisions of all leases, subleases, and other contracts relating to exploration, drilling, development, or utilization of geothermal resources on lands committed to this Agreement, are hereby expressly modified and amended only to the extent necessary to make the same conform to the provisions hereof, otherwise said leases, subleases, and contracts shall remain in full force and effect.

17.2 The parties hereto consent that the Secretary shall, by his approval hereof, modify and amend the Federal leases committed hereto and the regulations in respect thereto to the extent necessary to conform said leases and regulations to the provisions of this Agreement.

17.3 The development and/or operation of lands subject to this Agreement under the terms hereof shall be deemed full performance of any obligations for development and operation with respect to each and every separately owned tract subject to this Agreement, regardless of whether there is any development of any particular tract of the Unit Area.

17.4 Drilling and/or producing operations performed hereunder upon any tract of Unitized Lands will be accepted and deemed to be performed upon and for the benefit of each and every tract of Unitized Land.

17.5 Suspension of operations and/or production on all Unitized Lands pursuant to direction or consent of the Secretary or his duly authorized representative shall be deemed to constitute such suspension pursuant to such direction or consent as to each and every tract of Unitized Land. A suspension of operations and/or production limited to specified lands shall be applicable only to such lands.

17.6 Subject to the provisions of Article XV hereof and 17.10 of this Article, each lease, sublease, or contract relating to the exploration, drilling, development, or utilization of geothermal resources of lands other than those of the United States committed to this Agreement, is hereby extended beyond any such term so provided therein so that it shall be continued for and during the term of this Agreement.

17.7 Subject to the lease renewal and the readjustment provision of the Act, any Federal lease committed hereto may, as to the Unitized Lands, be continued for the term so provided therein, or as extended by law. This subsection shall not operate to extend any lease or portion thereof as to lands excluded from the Unit Area by the contraction thereof.

17.8 Each sublease or contract relating to the operations and development of Unitized Substances from lands of the United States committed to this Agreement shall be continued in force and effect for and during the term of the underlying lease.

17.9 Any Federal lease heretofore or hereafter committed to any such unit plan embracing lands that are in part within and in part outside of the area covered by any such plan shall be segregated into separate leases as to the lands committed and the lands not committed as of the effective date of unitization.

17.10 In the absence of any specific lease provision to the contrary, any lease, other than a Federal lease, having only a portion of its land committed hereto shall be segregated as to the portion committed and the portion not committed, and the provisions of such lease shall apply separately to such segregated portions commencing as of the effective date hereof. In the event any such lease provides for a lump-sum rental payment, such payment shall be prorated between the portions so segregated in proportion to the acreage of the respective tracts.

17.11 Upon termination of this Agreement, the leases covered hereby may be maintained and continued in force and effect in accordance with the terms, provisions, and conditions of the Act, the lease or leases, and amendments thereto.

ARTICLE XVIII—EFFECTIVE DATE AND TERM

18.1 This Agreement shall become effective upon approval by the Secretary or his duly authorized representative and shall terminate five (5) years from said effective date unless,

(a) Such date of expiration is extended by the Director, or

(b) Unitized Substances are produced or utilized in commercial quantities in which event this Agreement shall continue for so long as Unitized Substances are produced or utilized in commercial quantities, or

(c) This Agreement is terminated prior to the end of said five (5) year period as heretofore provided.

18.2 This Agreement may be terminated at any time by the owners of a majority of the Working Interests, on an acreage basis, with the approval of the Supervisor. Notice of any such approval shall be given by the Unit Operator to all parties hereto.

ARTICLE XIX—APPEARANCES

19.1 Unit Operator shall, after notice to other parties affected, have the right to appear for and on behalf of any and all interests affected hereby before the Department of the Interior, and to appeal from decisions, orders or rulings issued under the regulations of said Department, or to apply for relief from any of said regulations or in any proceedings relative to operations before the Department of the Interior or any other legally constituted authority: *Provided, however,* That any interested parties shall also have the right, at its own expenses, to be heard in any such proceeding.

ARTICLE XX—NO WAIVER OF CERTAIN RIGHTS

20.1 Nothing contained in this Agreement shall be construed as a waiver by any party hereto of the right to assert any legal or constitutional right or defense pertaining to the validity or invalidity of any law of the State wherein lands subject to this Agreement are located, or of the United States, or regulations issued thereunder, in any way affecting

such party or as a waiver by any such party of any right beyond his or its authority to waive.

ARTICLE XXI—UNAVOIDABLE DELAY

21.1 The obligations imposed by this Agreement requiring Unit Operator to commence or continue drilling or to produce or utilize Unitized Substances from any of the land covered by this Agreement, shall be suspended while, but only so long as, Unit Operator, despite the exercise of due care and diligence, is prevented from complying with such obligations, in whole or in part, by strikes, Acts of God, Federal or other applicable law, Federal or other authorized governmental agencies, unavoidable accidents, uncontrollable delays in transportation, inability to obtain necessary materials in open market, or other matters beyond the reasonable control of Unit Operator, whether similar to matters herein enumerated or not.

21.2 No unit obligation which is suspended under this section shall become due less than thirty (30) days after it has been determined that the suspension is no longer applicable.

21.3 Determination of creditable "Unavoidable Delay" time shall be made by the Unit Operator subject to approval of the Supervisor.

ARTICLE XXII—POSTPONEMENT OF OBLIGATIONS

22.1 Notwithstanding any other provisions of this Agreement, the Director, on his own initiative or upon appropriate justification by Unit Operator, may postpone any obligation established by and under this Agreement to commence or continue drilling or to operate on or produce Unitized Substances from lands covered by this Agreement when in his judgement, circumstances warrant such action.

ARTICLE XXIII—NONDISCRIMINATION

23.1 In connection with the performance of work under this Agreement, the Operator agrees to comply with all of the provisions of section 202 (1) to (7) inclusive, of Executive Order 11246 (30 F.R. 12319), as amended by Executive Order 11375 (32 F.R. 14303), which are hereby incorporated by reference in this Agreement.

ARTICLE XXIV—COUNTERPARTS

24.1 This Agreement may be executed in any number of counterparts no one of which needs to be executed by all parties, or may be ratified or consented to by separate instruments in writing specifically referring hereto, and shall be binding upon all parties who have executed such a counterpart, ratification or consent hereto, with the same force and effect as if all such parties had signed the same document.

ARTICLE XXV—SUBSEQUENT JOINDER

25.1 If the owner of any substantial interest in geothermal resources under a tract within the Unit Area fails or refuses to subscribe or consent to this Agreement, the owner of the Working Interest in that tract may withdraw said tract from this Agreement by written notice delivered to the Supervisor and the Unit Operator prior to the approval of this Agreement by the Supervisor.

25.2 Any geothermal resources interests in lands within the Unit Area not committed hereto prior to approval of this Agreement may thereafter be committed by the owner or owners thereof subscribing or consenting to this Agreement, and, if the interest is a Working Interest, by the owner of such interest also subscribing to the Unit Operating Agreement.

25.3 After operations are commenced hereunder, the right of subsequent joinder, as provided in this Article XXV, by a Working Interest Owner is subject to such requirements or approvals, if any, pertaining to such joinder, as may be provided for in the Unit Operating Agreement. Joinder to the Unit Agreement by a Working Interest Owner, at any time, must be accompanied by appropriate joinder to the Unit Operating Agreement, if more than one committed Working Interest Owner is involved, in order for the interest to be regarded as committed to this Unit Agreement.

25.4 After final approval hereof, joinder by a nonworking interest owner must be consented to in writing by the Working Interest Owner committed hereto and responsible for the payment of any benefits that may accrue hereunder in behalf of such nonworking interest. A nonworking interest may not be committed to this Agreement unless the corresponding Working Interest is committed hereto.

25.5 Except as may otherwise herein be provided, subsequent joinders to this Agreement shall be effective as of the first day of the month following the filing with the Supervisor of duly executed counterparts of all or any papers necessary to establish effective commitment of any tract to this Agreement unless objection to such joinder is duly made within sixty (60) days by the Supervisor.

ARTICLE XXVI—COVENANTS RUN WITH THE LAND

26.1 The covenants herein shall be construed to be covenants running with the land with respect to the interest of the parties hereto and their successors in interest until this Agreement terminates, and any grant, transfer, or conveyance, of interest in land or leases subject hereto shall be and hereby is conditioned upon the assumption of all privileges and obligations hereunder by the grantee, transferee, or other successor in interest.

26.2 No assignment or transfer of any Working Interest or other interest subject hereto shall be binding upon Unit Operator until the first day of the calendar month after Unit Operator is furnished with the original, photostatic, or certified copy of the instrument of transfer.

ARTICLE XXVII—NOTICES

27.1 All notices, demands or statements required hereunder to be given or rendered to the parties hereto shall be deemed fully given if given in writing and personally delivered to the party or sent by postpaid registered or certified mail, addressed to such party or parties at their respective addresses set forth in connection with the signatures hereto or to the ratification or consent hereof or to such other address as any such party may have furnished in writing to party sending the notice, demand or statement.

ARTICLE XXVIII—LOSS OF TITLE

28.1 In the event title to any tract of Unitized Land shall fail and the true owner cannot be induced to join in this Agreement, such tract shall be automatically regarded as not committed hereto and there shall be such readjustment of future costs and benefits as may be required on account of the loss of such title.

28.2 In the event of a dispute as to title as to any royalty, Working Interest, or other interests subject hereto, payment or delivery on account thereof may be withheld without liability for interest until the dispute is finally settled: *Provided*, That, as to Federal land or leases, no payments of funds due the United States shall be withheld, but such funds shall be deposited as directed by the Supervisor to be held as unearned money

pending final settlement of the title dispute, and then applied as earned or returned in accordance with such final settlement.

ARTICLE XXIX—TAXES

29.1 The Working Interest Owners shall render and pay for their accounts and the accounts of the owners of nonworking interests all valid taxes on or measured by the Unitized Substances in and under or that may be produced, gathered, and sold or utilized from the land subject to this Agreement after the effective date hereof.

29.2 The Working Interest Owners on each tract may charge a proper proportion of the taxes paid under 29.1 hereof to the owners of nonworking interests in said tract, and may reduce the allocated share of each royalty owner for taxes so paid. No taxes shall be charged to the United States or the State of ____________ or to any lessor who has a contract with his lessee which requires the lessee to pay such taxes.

ARTICLE XXX—RELATION OF PARTIES

30.1 It is expressly agreed that the relation of the parties hereto is that of independent contractors and nothing in this Agreement contained, expressed, or implied, nor any operations conducted hereunder, shall create or be deemed to have created a partnership or association between the parties hereto or any of them.

ARTICLE XXXI—SPECIAL FEDERAL LEASE STIPULATIONS AND/OR CONDITIONS

31.1 Nothing in this Agreement shall modify special lease stipulations and/or conditions applicable to lands of the United States. No modification of the conditions necessary to protect the lands or functions of lands under the jurisdiction of any Federal agency is authorized except with prior consent in writing whereby the authorizing official specifies the modification permitted.

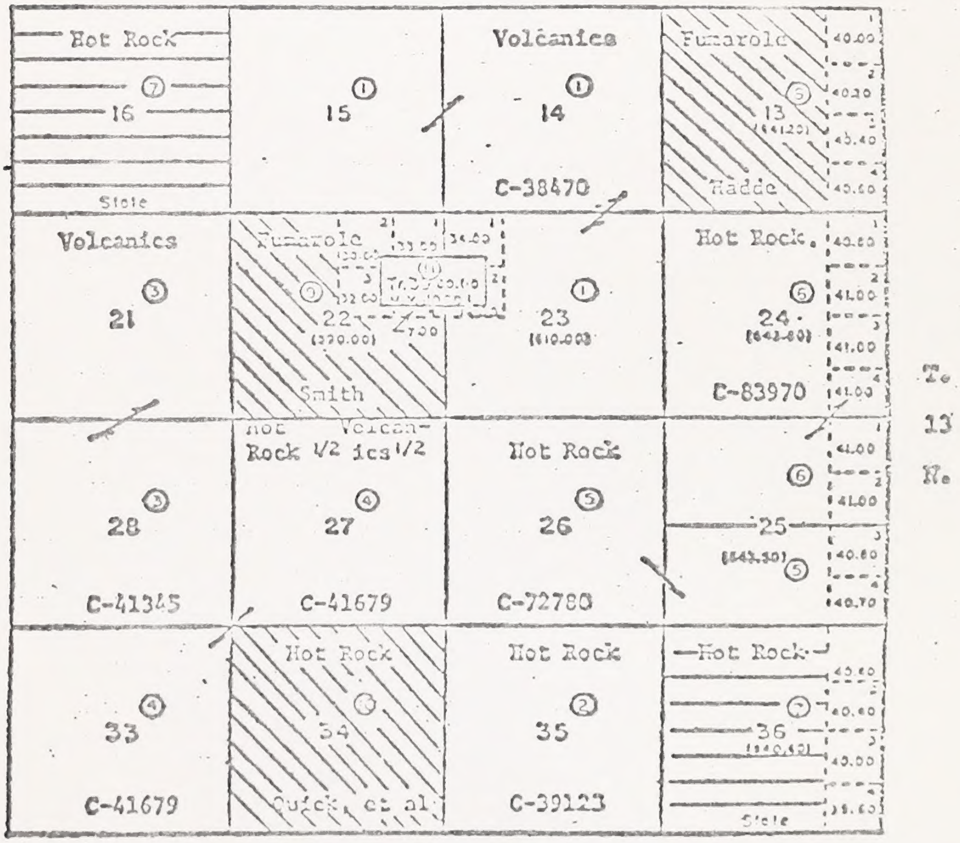
In witness whereof, the parties hereto have caused this Agreement to be executed and have set opposite their respective names the date of execution.

Witnesses:	Unit operator (as unit operator and as working interest owner)
____________________	____________________
____________________	By ____________________
Witnesses:	Working Interest Owners:
____________________	____________________
____________________	By ____________________
Witnesses:	Other Interest Owners:
____________________	____________________
____________________	By ____________________

§ 271.13 Sample form of Exhibit A of unit agreement.

EXHIBIT A—BIG VAPOR UNIT AREA, T. 13 N., R. 10 W., M.D.M., California

R. 1 W.



① Means tract number as listed on Exhibit B

☐ PUBLIC LAND

▤ STATE LAND

▨ PATENTED LAND

APPENDIX C

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Soils

The Kilbourne Hole-Potrillo Mountain proposed lease area contains 12 soil associations. These consist of: 1. Bluepoint-Yturbide, 2. Rough Broken Land-Bluepoint-Caliza, 3. Mohave-Stellar, 4. Pintura-Berino-Simona, 5. Coaque-Pintura, 6. Simona-Cacique, 7. Nickel-Tencee-Delnorte, 8. Rockland-Rough Broken Land, 9. Rockland-Rough Broken Land, 10. Lava Rockland, 11. Hondale-Mimbres-Bluepoint, and 12. Rickland-Lehmans.

1. Bluepoint-Yturbide Association

The Bluepoint-Yturbide Association covers a very small area on the west side of the Rio Grande River just above the flood plain. (Illustration 19). It consists of gently sloping and undulating alluvial fans and terraces. Dominant slopes range from 2 to 3 percent. Small steeper sandy ridges and associated arroyos and drainages attain slopes of 10 to 15 percent. Deep sandy soils of this association are formed in alluvial (water moved) and eolian (wind moved) sediments of mixed origin. Soils of this association are very susceptible to wind erosion, and therefore, due to the shifting soil material, sand dunes have developed around shrubs. This area is dissected by numerous east-west drainages and arroyos of varying size (16).

Vegetative cover is sparse. Plant species found in association with these soils are: mesquite (Prosopis juliflora), fourwing saltbush (Atriplex canescens), broom snakeweed (Gutierrezia sarothrae), sand dropseed (Sporobolus cryptandrus), fluffgrass (Tridens pulchellus) and many annual grasses and forbs (16).

Land use of this area is mostly for homesites and associated urban uses. Maker _et al._, (16) reports that these soils are generally well adapted to this use even though they are sandy and erodible.

Bluepoint soils are the most widespread soils of this association and are classed as loamy sand. They are found on gently sloping and undulating alluvial fans with a slope of 1 to 5 percent. A surface layer of light brown to light brownish-gray soil is characteristic of this series with non-calcareous to weakly calcareous loamy sand or sand. Subsurface light brown loamy sand and sand are at least five feet deep. Isolated areas in this association contain a few pebbles and gravel or a thin strata of gravelly loamy sand and sand while the rest of these soils are non-gravelly. No calcareous accumulations occur except for a thin coating on sand grains and pebbles. The permeability of the Bluepoint soils is very rapid. The available water holding capacity is low at 2.5 to 4 inches. Due to the sandiness of the soil, it has a low shrink-swell potential (Table 4) (16).

The Bluepoint soils possess varying properties used in construction activities. These soils are sandy and erode very easily. Therefore, they are not recommended for topsoil, in exposed embankments in reservoir construction, in locating highways, and in sanitary land fills. However, these soils are suitable as a source of roadfill, for septic tank filter fields, and for foundation support (Table 5) (16).

Yturbide soils occur on gravelly ridges and associated drainages throughout this association. Maker, _et al._, (16) reports that the surface consists of light brown weakly calcareous loamy sand or gravelly

loamy sand. Gravelly loamy sand, loamy sand, and sand are found to a depth of 5 feet or more from the surface. Gravel in this soil ranges from 15 to 35 percent. A low available water holding capacity of 2.5 to 4 inches, a rapid permeability, and a low shrink-swell potential are characteristic of this sandy soil (Table 4).

The Yturbide soils possess varying properties used in construction activities. This sandy soil is not recommended for use as topsoil, in locating highways, in reservoir construction, and in sanitary landfills. It is, however, good roadfill material, possesses only slight limitations in septic tank drainage fields, and will support foundations (Table 5).

Small isolated areas of Nickel soil, sand dunes, alluvial land, and riverwash are present in this association. The crest of ridges contain the Nickel soils. Sand dunes form around shrubs and consist of fine loose sand. The riverwash is found in arroyo bottoms and is composed of sand, gravel, and cobble (16).

2. Rough Broken Land - Bluepoint - Caliza Association

The Rough Broken Land - Bluepoint - Caliza Association includes the rough broken lands that follow the entire length of the Rio Grande (Figure 19). Slopes of up to 35 percent are found within the moderate to steep areas dissected by many drainageways. These lands grade to gently sloping fans and terraces as they approach the Rio Grande flood plain. Gravel and coarse textured materials of mixed origin are found in these alluvial fans associated with these soils (16).

The stand of vegetation in this association is sparse. Creosote

bush (Larrea tridentata) dominates with lesser amounts of mesquite, soaptree yucca (Yucca elata), broom snakeweed, black grama (Bouteloua eriopoda), mesa dropseed (Sporobolus flexuosus), fluffgrass, various cacti (Opuntia spp), and a number of annual forbs and grasses (16).

Rough Broken Land soils of this association occur on the steep and rougher area dissected by many intermittent streams channels. The slope of these lands range from 15 to 50 percent. The soils are widely varying, shallow, alluvial sediments. The subsoils vary as widely as the surface soils, consisting of soft or hard caliche layers or old deposited layers of reddish brown sandy clay loam or clay loam. The surface soils are gravelly, being classed as gravelly loam or gravelly sandy loam. Bedrock may appear in isolated areas in mountainous and hilly country. Active erosion is common in this soil association. No other soil properties or engineering interpretations are available for this soil (16).

Bluepoint soils of this association are found on the gentle sloping alluvial fans. They have a slope that ranges from 1 to 10 percent. Other information of the Bluepoint soils are described in association 1.

Caliza soils are found on gently sloping crests of narrow ridges ranging in slope from 1 to 5 percent. Maker, et. al. (16) report that the surface layer is a pinkish-gray, strongly calcareous, and very gravelly sandy loam. The subsoils are pinkish white, very gravelly sandy loam to a depth of 20 inches. Carbonates may range from none to a nearly continuous weak cementation. The carbonates decrease with depth and at 36 inches there is little or no sign of carbonates.

Permeability of this soil is rapid. The available water holding capacity is 2 inches. A low shrink-swell potential is characteristic of this soil (Table 4).

The Caliza soils possess varying properties used in construction activities. This soil is not recommended as a source of topsoil or in the construction of reservoirs. However, this soil may be used in locating highways, if a binder is added; drainage fields for septic tanks, with slight limitations; good bearing capacity for the support of foundations; and used in sanitary landfills (Table 5).

Many other soils are found in this association in small isolated areas. These soils are: Yturbide, Nickel, Pajarito, Upton, Tencee, Dalian, and Arizo series in association with riverwash, arroyo bottoms, and other miscellaneous soils. These soils are characteristically deep gravelly loamy sands, deep sandy loams, shallow, and some contain hard caliche (16).

3. Mohave-Stellar Association

The Mohave-Stellar Association is widely distributed and includes the nearly level to gently sloping basin floors, drainageways, swales, and lower parts of mountains (Figure 19). These soils are dominately deep medium to fine textured soils, although some areas may vary. Soils of this association have formed from old valley filled sediments of mixed origin (16).

This association supports a fair cover of plant species. Maker, et. al., (27) reports that these include tobosa (Hilaria mutica), black grama, burrograss (Scleropogon brevifolius), sand dropseed, poverty

threeawn (Aristida divaricata), red threeawn (Aristida longiseta), and small amounts of tarbush (Flourensia cernua), mesquite, and creosote bush.

A few scattered tracts of land in this association are used for irrigation, while the rest of the land is grazed by livestock. Fair yield in forage is obtained only under good management and average, or above average rainfall.

The Mohave soils are extensively distributed in this association. They are found in the gentle sloping foothills ranging from 0 to 3 percent. A thin reddish-brown noncalcareous sandy clay loam is present on the surface. Subsoils are reddish-brown clay loam with a few prominent streaks and soft masses of lime in the lower part. The lower subsoils are light reddish-brown, sandy clay loam or sandy loam with calcium carbonate occurring in finely divided forms and as thin seams and streaks. Some gravels may be found at depths of 4 to 6 feet. Permeability of this soil is slow. It has a water holding capacity 6 to 7 inches. The shrink-swell potential is low (Table 4) (16).

The Mohave soils possess varying properties used in construction activities. Septic tank drain fields are not recommended due to the slow permeability of the soil. The first 6 to 8 inches of this soil can be used as topsoil. Roadfill material, highway location, and foundation support are marginal on this soil. However, these soils are suitable for the construction of reservoirs when the soil is compacted (Table 5).

The Stellar soils are as extensive as the Mohave soils, but occur

at slightly lower elevations. Stellar soils occur in very gently sloping drainageways and swales, and on nearly level parts of the basin floor areas with slopes of 0 to 3 percent. The surface is composed of a thin layer of pinkish-gray noncalcareous or calcareous sandy clay loam or clay loam. Subsoils are thick reddish-brown clay or heavy clay loam that usually contains seams and soft masses of lime in the lower parts (16). A light reddish brown clay loam or gravelly clay loam with visible calcium carbonate occurring in finely divided forms and as small soft masses and seams are found in the substratum. Permeability of this soil is low. This soil has an available water holding capacity of 6 to 7 inches. The shrink-swell potential is moderate (Table 4).

Stellar soils possess varying properties used in construction activities. The top 5 to 8 inches can be used for topsoil. This soil is not the best for road fill or highway locations. A septic tank drainage field is not advised for this soil because of the slow permeability. It is only fair foundation support. Reservoirs can be built if the soil is compacted. Stellar soils are favorable for use in sanitary land fills (Table 5).

Berino soils are coarse textured and have more permeable subsoils. Slopes are from 0 - 3 percent. These soils are described as having a thin layer of brown to reddish-brown noncalcareous sandy loam or loamy sand over a thick reddish-brown sandy clay loam subsoil that commonly contain threads and small soft masses of lime in the lower part (16). Subsoils of 3 to 4 feet are described as pinkish-white sandy clay loam with a high lime content. Moderate permeability, a 5 to 6 inch available water holding capacity and low shrink-swell potential are also

characteristic of this soil (Table 4).

Berino soils possess varying properties used in construction activities. This soil does not make a good topsoil. It is marginal when used for roadfill and septic tank drainages fields. Foundation support, highway location, reservoir construction with compaction, and sanitary landfills are suitable uses on this soil (Table 5).

Reakor soils are found more commonly on the east side of the Rio Grande. The lower basin floors are occupied by this soil with slopes of 0-1 percent. The surface is composed of strongly calcareous silt loam, loam, or clay loam. The underlying subsoil is a light brown strongly calcareous light clay loam of about 24 inches. A light brown, very strongly calcareous, silty clay loam, or clay loam to a depth of 60 inches or more comprises the substratum. Below 2 feet, filaments and small soft masses of lime occur. Moderate permeability, are usually barren, but at times annuals and mesa dropseed are found in these interdune areas (16).

Pintura soils are associated with the sand dunes and gently rolling landscape. Maker, _et_. _al_., (16) report that the surface is composed of loose, noncalcareous to weakly calcareous brown or reddish-brown fine sand underlain by thick deposits of fine sand. Rapid permeability, an available water holding capacity of 2.5 to 3 inches, and a low shrink-swell potential are characteristic of this soil series (Table 4).

Pintura soils possess varying properties used in construction activities. These soils are not suitable for topsoil, locating highways, reservoir construction, or sanitary land fills. It can be considered for use in roadfill material, drainage fields for septic tanks, and

good for foundation support if confined (16) (Table 5).

The nearly level to gently sloping interdune areas are occupied by Berino soils. A discussion of these soils occurs in association 3.

Nearly level to very gently sloping landscapes are occupied by Simona soils. These soils are the least extensive of the major soils in the association (16). The surface soils are light brown calcareous sandy loam or loamy sand. A pale brown fine sandy loam subsoil contains angular caliche fragments. At less than 20 inches, white or pinkish-white strongly cemented caliche occurs. Cementation is strong in the first 12 inches and then decrease with depth. Other characteristics of these soils are: rapid permeability, 1 to 3 inches of available water holding capacity, and a low shrink-swell potential (Table 4).

Simona soils possess varying properties used in construction activities. It is not suitable for topsoil, drainage field for septic tanks, highway location, reservoir construction, or sanitary landfills. It is suitable for roadfill and foundation support (Table 5) (16).

Some other soils are present in small portions. These are active Duneland, Mohave, Bluepoint, Wink, and Akela soils.

5. Cacique-Pintura Association

The Cacique-Pintura Association is the largest soil association in the proposed geothermal lease area (Figure19). These soils are found west of the Rio Grande in the southcentral portion of Dona Ana County. This association is found on the upland plains with slope gradients of less than 3 percent. A microrelief of sand dunes form around shrubs of mesquite, ranging from about 3 to more than 8 feet

in height. These soils are sandy sediments of mixed origin. Moderately deep soils predominate this soil association although some shallow to deep soils do occur. A 6 to 24 inch hard caliche underlies these soils (16).

This association is commonly used for grazing. Good management is needed to prevent further deterioration from wind erosion.

Native vegetation is dominated by shrubs. Mesquite, fourwing saltbush, soaptree yucca, and creosote bush dominate these soils. Black grama, bush muhly (Muhlenbergia porteri). fluffgrass, and burrograss may be found in limited quantities within this soil association. The dunes contain the largest amount of vegetation while the interdunes are barren or contain only annual forbs (16).

Cacique soils are the most extensive soils present in this association. They are found on nearly level to very gently sloping topography on the plain of 0 to 3 percent. Maker, et.al., (16) reports that a thin reddish-brown sandy clay loam covers the surface. The calcareous subsoil is composed of a few filaments and small soft masses of lime. Hard caliche is present at 20 to 40 inches below the surface. Laminar and hard caliche layers are usually confined to the upper 6 to 24 inches of this horizon. Wind erosion has removed much of the surface horizon of the Cacique soils, at least in the interdune areas. A soil within this association that is similar to Cacique possesses similar color, depth, and texture but differs in that it is calcareous from the surface downward with no well developed subsoil. Cacique soils have moderate permeability, a 3 to 5 inch available water holding capacity, in terrane. These soils are some sediments of mixed origin. Moderately deep soils predominate [illegible] soil [illegible] use and fertility [illegible] 10 & 15 to 20 inch [illegible] soils (10).

Soil conservation is currently used for grazing. Some management is needed to prevent further deterioration from wind erosion.

Native vegetation is dominated by grasses. Bluestem, [illegible] [illegible] and [illegible] these soils. Other grassy [illegible] *[illegible]*, [illegible] may be found [illegible] quantities [illegible] hills and [illegible]. The [illegible] the largest amount of [illegible] the [illegible] (10).

Because soils are the most [illegible] present in this [illegible] [illegible] *[illegible]* (11) [illegible] the surface. The [illegible]

[illegible]

and a low shrink-swell potential (Table 4).

The Cacique soils possess varying properties used in construction activities. These soils are poorly suited for use as topsoil, roadfill material, drainage fields for septic tanks, reservoir construction, and sanitary landfills. However, it is suitable for building construction and highway locations (Table 5).

Pintura soils are associated with sand dunes in the gently rolling and duny areas. A discussion of these soils is found in association 4.

Wink soils are found in slight depressions ranging in slopes of less than 3 percent. Surface soils are strongly calcareous. Subsoils have rapid permeability and a soft caliche (16). A 2 to 3 inch available water holding capacity is characteristic of Wink soils. This soil also has a low shrink-swell potential (Table 4).

The Wink soils possess varying properties used in construction activities. These soils show unfavorable uses as topsoil; drainage fields for septic tanks; highway location, due to drifting sand; in reservoir construction; and sanitary landfills. It can be used as roadfill material and will support building construction (Table 5).

Other important soils in this association are: Dona Ana, Simona, Jal, Cruces, and Berino series. Dona Ana soils are reddish-brown calcareous sandy loams. Soft caliche is present at depths of 18 to 20 inches. Simona soils are discussed in association 4. Jal soils are shallow and are underlain to a depth of less than 20 inches by soft caliche. Cruces soils characteristically have sandy loam surface soils, a sandy clay loam subsoil, and hard caliche at 12 to 20 inches (16). Berino soils are mentioned in association 4.

6. Simona-Cacique Association

The Simona-Cacique Association occurs on nearly level to very gently sloping upland plains with a slope of no more than 3 percent. This association is found north of the lava flow in the proposed geothermal lease area(Figure19). Most of the soils in this association are shallow, although some moderate to deep soils occur. These soils are underlain by strongly cemented caliche. Sandy surface layers susceptible to wind erosion are common. Even with loose sands of this association very few sand dunes are present. These dunes rarely are over 3 feet high (16).

This association is used for grazing. No other extensive agricultural practices exist in this soil association.

A fair vegetative cover is present in this soil association. Black grama, mesa dropseed, fluffgrass, and burrograss are the main grasses found on the soils. Shrubs of the area are: creosote bush, mesquite, tarbush, broom snakeweed, and soaptree yucca. Maker, et. al., (16) report that small swales and depressions may contain limited amounts of tobosa grass. This soil association consists of pure stands of grass (black grama), mixed stands of grass (black grama-mesa dropseed), and grasses mixed with shrubs (black grama - soaptree yucca).

The most extensive soils in this association are Simona soils. They occupy the nearly level to gently sloping uplands. A further discussion of this soil series is found in association 4.

Cacique soils are found in very slight depressions that are nearly level or very gently sloping. A further discussion of this soil series is found in association 5.

This association also contains small areas of Tonuco, Cruces, Dona Ana, Pajarito, Berino, and Wink soils. The Tonuco soils are coarse-textured soils underlain by hard caliche at depths of 6 to 20 inches. Cruces soils are characterized by a sandy surface, sandy clay loam subsoils, and a hard caliche at 12 to 20 inches. Dona Ana soils are reddish-brown calcareous sandy loam or loamy sand surface soils with sandy clay loam subsoils. Dona Ana soils have a soft caliche at 18 to 30 inches in depth. Pajarito soils are deep sandy loams (16). Berino soils are discussed in association 3 and Wink soils are discussed in association 5.

7. Nickel-Tencee-Delnorte Association

The Nickel-Tencee-Delnorte association is not an extensive soil association in the proposed geothermal lease area (Figure 19). This soil is found on the sparsely to strongly dissected areas adjacent to the base of desert mountains and hills. Many intermittent streams and arroyos originating in the adjacent mountains dissect this type. The ridge crests, fans, and terraces of the lower areas have a slope of 2 to 5 percent. The higher areas near the mountains have slopes of up to 10 percent. Some ridges adjacent to arroyo bottoms exceed 10 percent. Gravelly or cobbly soils of mixed origin are found in alluvial fans (16).

This area supports a sparse to fair cover of vegetation. Grasses found in this association include: fluffgrass, black grama, mesa dropseed, and small amounts of bush muhly, tobosa, poverty threeawn, and red threeawn. Blue grama (Bouteloua gracilis) and sideoats grama

This association also contains the small areas of [illegible] Cinder, [illegible] soils. The former soils are [illegible] or depths of 20 to 40 inches. [illegible] soils are characterized by a [illegible] texture, [illegible] 15 to 20 inches. Some [illegible] sand surface [illegible]. Some fine sandy soils have a soft [illegible] (1975). [illegible] are discussed in [illegible].

C. [illegible]

The natural [illegible] soil [illegible]. This [illegible] is found in the [illegible] and [illegible] soils. [illegible] of 0 to 3 percent. The highest [illegible] 20 to 30 percent, [illegible] 10 percent. [illegible] (1974).

[illegible]

(*Bouteloua curtipendula*) may be found at higher elevations near the mountains (16). Dominant shrubs include creosote bush, broom snakeweed, soaptree yucca, tarbush, and many species of cacti.

One of the most extensive soils of this association is the Nickel series (16). These soils are characterized by a thin surface layer of light-brown or light brownish-gray calcareous gravelly sandy loam and light-brown gravelly or very gravelly loam subsoils. White, very gravelly caliche shows up at depths of 15 to 25 inches and contains many hard caliche fragments. It may be weakly cemented in the upper portion of the soil profile. Nickel soils have a slope of 0 to 10 percent, rapid permeability, a 1 to 2 inch available water holding capacity, and a low shrink-swell potential (Table 4).

The Nickel soils possess varying properties used in construction activities. These soils do not make good topsoils due to their gravelly nature. Subject to seepage these soils are not suited for reservoir construction. They are, however, suited for roadfill material, drainage fields for septic tanks, building construction, highway locations, and sanitary landfills (Table 5).

Tencee soils are also found on gently to strongly sloping landscapes, ranging from 0 -10 percent. The surface layer of these soils are thin light brown, calcareous, very gravelly loam, or very gravelly sandy loam. Subsoils are pale brown, very limy, and very gravelly loam. This is underlain with hard caliche, ranging in depth from 6 to 20 inches. Cementation decreases with depth. Other characteristic of this soil are: a rapid permeability, a 1 to 2 inch available water holding

capacity, and a low shrink-swell potential (Table 4) (16).

The Tencee soils possess varying properties used in construction activities. These soils are not recommended as topsoils, as drainage fields for septic tanks, in reservoir construction, or sanitary landfills. Roadfill material, supporting building construction, and highway location are suitable uses of this soil series (Table 5) (16).

Delnorte soils are not as limy as the Tencee soils. The surface is a light-brown calcareous, very gravelly loam, or very gravelly sandy loam, over hard caliche. (16) This hard caliche is laminar and strongly cemented in the first 6 to 12 inches and becomes less hard with depth. Other characteristics of this soil series are: slopes of 0-10 percent, rapid permeability, a 1 to 2 inch available water holding capacity, and a low shrink-swell potential (Table 4).

Delnorte soils possess varying properties used in construction activities. Activities not suitable for these soils are: topsoil, drainage fields for septic tanks, reservoir construction, and sanitary landfills. It is recommended for roadfill material, building construction, and highway locations (Table 5).

There are a number of other soil series within this association. They are: Upton, Terino, Sonorta, Pinaleno, Dona Ana, Aladdin, Turney, Palian, and Arizo series. Upton and Terino soils are underlain by hard caliche at less than 20 inches in depth. Upton soils do not contain high amounts of gravel. Terino soils are thin with a light-colored, noncalcareous, gravelly surface layer. Subsoils are very gravelly sandy clay loam. Gently sloping landscapes contain Sonorta soils.

The surface is composed of a thin layer of brown, noncalcareous, gravelly sandy loam. This is underlain by a reddish-brown gravelly sandy clay loam subsoil. The substratum is very gravelly at depths of 30 to 40 inches. Dona Ana soils are sandy with sandy clay loam subsoils. These soils are underlain by soft caliche at depths of 18 to 30 inches. Pinaleno and Aladdin soils are found along the piedmont slopes on mountain fronts in association with igneous rocks (16). These soils have noncalcareous, gravelly loamy sand, or gravelly sandy loam surface soils. These soils are underlain by moderately coarse to coarse-textured soils. Aladdin soils have dark surface layers and less gravelly than the Pinaleno soils. Dalian and Arizo soils are deep and very gravelly soils that occur on alluvial fans and terraces adjacent to intermittent drainages. Dalian soils are very limy throughout the upper 40 inches and Arizo soils are not. Turney soils are calcareous sandy clay loam surface soils. Subsoils are soft or weakly cemented caliche at depths of 20 to 40 inches.

8. Rockland-Rough Broken Land Association

The Rockland-Rough Broken Land Association includes soils associated with mountain ranges, isolated mountain peaks, ridges, and hills (Figure 4). These soils are found on steep to very steep slopes ranging from 10 to 75 percent. The soils are characteristically shallow and rocky with numerous exposures of bedrock. Many types of bedrocks are present and include monzonite, rhyolite, limestone, shale, and sandstone (16).

This area is used primarily for grazing but in some areas even

grazing is limited due to the steep slopes and roughness of the land surface.

The density of vegetation is also reduced due to the roughness of the area. A wide variety of grasses, shrubs, and trees grow in this area. Black grama, sideoats grama, blue grama, bush muhly, Indian ricegrass (Orizopsis hymenoides), little bluestem (Schizachyium scoparium), galleta (Hilaria jamesii), sand dropseed, poverty threeawn, and red threeawn are the dominant grasses found growing on these soils. One-seed juniper (Juniperus monosperma), shrub live oak (Quercus turbinella), wolfberry (Lycuim berlandieri) Apache plume (Fallugia paradoxa), soaptree yucca, creosote bush, and many species of cacti are also found on these soils (16).

The major component of the Rockland-Rough Broken Land Association is the Rockland series. Maker, et. al., (16) reports that these soils are composed of many shallow soils and exposed bedrock. The exposed bedrock is usually vertical ledges with slopes of 15 to 75 percent. The areas between the bedrock outcrops are covered with a thin layer of cobbly or stony soils. No other soil properties or engineering interpretations are given for this soil series.

Lehman soils are also important in this association. They are found on the moderately steep and rolling hills with slopes of 10 to 35 percent. Maker, et. al., (16) reports that these soils are described as having a thin brown stony loam surface layer with reddish brown gravelly or stony clay subsoils and are underlain by acid igneous bedrock no more than 20 inches from the surface. These soils have a

very slow permeability, a water holding capacity of 2 to 3 inches, and a moderate shrink-swell potential (Table 4).

The Lehman soils possess varying properties used in construction activities. These soils are not suitable for topsoil, roadfill material, drainage field for septic tanks, locating highways, reservoir construction, and locating sanitary landfills. It does have good support qualities needed in building but the access is very limited (Table 5).

The Lozier soils are a small series within this soil association. They are characterized by: slopes of 5 to 35 percent, a surface texture of stony loam, calcareous stony loam and stony clay loam subsoils, a moderate permeability, a substratum of limestone bedrock at no more than 20 inches from the surface, an available water holding capacity of 1 to 3 inches, and a moderate shrink-swell potential (Table 4). No engineering interpretations were made for this series (16).

The Rockland-Rough Broken Land Association also includes the Latom, Nickel, and Upton series, rough broken and stony land; gravelly alluvial land; and isolated pockets or extremely small areas of moderately deep and deep unclassified soils. These soils are mostly miscellaneous shallow soils that make up less than 20 percent of this soil association (16).

9. Rockland-Akela-Graham Association

The Rockland-Akela-Graham Association is a very large and extensive soil association (Figure 4). It includes all areas where soils have formed over basceltic lava flows and cinder cones. Wind blown sands

have been deposited over a large portion of the basaltic rock. This depositing has significantly contributed to the parent material of soils in this association. These sands vary from a thin layer to more than five feet. Gently to moderately sloping lava flows contain the thicker deposits of sand. A large portion of the area is not covered by these wind deposited sands, therefore, outcrops of bedrock and stony soils appear. This soil association has a varied landscape ranging from gently sloping plains to steeply sloping and rolling hills and cinder cones (16).

This varied topography supports a number of vegetative species. These include black grama, mesa dropseed, fluffgrass, tobosa, creosote bush, tarbush, and many species of cacti.

Rockland soils are associated with basalt outcrops, stony soils, and exposed steep side slopes and tops of cinder cones. A discussion of this soil series is found in association 8.

Akela soils have developed as a result of wind blown sediments producing the parent material. Maker,*et. al*. (16) report that the surface is pale brown very gravelly loam or very gravelly sandy loam. The subsoils are very gravelly and cobbly sandy loam or loam. Bedrock occurs at 10 to 20 inches from the surface. A lime coating is common around cobbles and gravel just above the bedrock. The surface may be spotted with basalt boulders and stones. These soils also are characterized by a moderate permeability, a 1 to 3 inch available water holding capacity, and a low shrink-swell potential (Table 4).

The Akela soils possess varying properties used in construction

activities. This soil is suitable for building construction, roadfill material, and locating highways, but does not possess properties needed in topsoil, drainage fields for septic tanks, reservoir construction, or locating sanitary landfills (Table 5).

Graham soils are shallow and are found on gently sloping to rolling landscapes. The thin brown surface layer is a stony loam. Reddish-brown clay with 10 to 15 percent basalt stones and gravels make up the subsoils, as they grade through very stony clay loam to basalt bedrock. The bedrock is usually within 20 inches of the surface. Lime usually coats the basalt stones above the bedrock. Other characteristics of this soil are: slow permeability a 2 to 3 inch available water holding capacity, and a low shrink-swell potential (Table 4).

The Graham soils possess varying properties used in construction activities. These soils are recommended for building construction and locating highways. It is not recommended for use as topsoil, roadfill material, drainage fields for septic tanks, construction of reservoirs, and locating sanitary landfills (Table 5).

Some isolated areas of moderately deep and deep soils occur in this association. The moderately deep soils are similar to Akela soils except that they are deeper to bedrock. The deep soils are medium textured to moderately fine-textured soils found in narrow swales, valley bottoms, and depressions (16). Berino and Pintura soils are found in this association but are discussed in association 4.

10. Lava Rockland Association

The Lava-Rockland Association includes the young basalt or lava substrates. This soil is suitable for building construction, roadfill [illegible] (Table 9).

[illegible]

[illegible] (Table 4).

[illegible]

[illegible]

[illegible]

[illegible]

flows with a slope of 0 to 10 percent (Figure19). These soils are extremely rocky, stony, and of a rough broken nature. Exposed rock with no soil, characterizes a large portion of these isolated areas. The areas that do contain soils possess a variety of soil types. Some of these soils are sandy while others are moderately fine-textured. The sandy soils are wind blown and are deposited over basalt rocks and boulders (16).

The Lava-Rockland Association is very rough. It has limited use for grazing but attracts hikers interested in plants and animals.

11. Rockland-Lehmans Association

The Rockland-Lehmans Association includes soils associated with mountain ranges, isolated mountain peaks, ridges, and hills (Figure19). The steep to very steep slopes, and shallow and rocky soils with exposed bedrock characterize the landscape occupied by these soils. Stony and extremely rocky soils of this association originate from acid igneous bedrock. Basalt and limestone contribute to the parent material of these soils.

The land is used for grazing. Many areas within this association are limited due to the steep slopes and rocky soils.

Rock outcrops restrict the areas that contain soil but the association still supports a wide variety of plant species. Common grasses are: black grama, blue grama, sideoats grama, bush muhly, Indian ricegrass, galleta, sand dropseed, poverty threeawn, and red threeawn. Creosote bush, soaptree yucca, Apache plume, wolfberry, shrub live oak, pinyon pine (Pinus edulis), and juniper are shrubs

commonly found in the area (16).

Rockland soils commonly occupy the steep slopes ranging from 15 to 75 percent. A discussion of this series is found in association 8.

Lehman soils occupy the moderately steep and rolling hills with a slope of 10 to 25 percent. A further discussion of this series is found in association 8.

Other soils in this association include: Akela, Ledru, Luxor, Graham, Lozier, Nickel, Upton, Brenda, Rough Broken, Stony Land, and Gravelly Alluvial Land. These soils are shallow, gravelly, stony, or rocky (15).

12. Hondale-Mimbres-Bluepoint Association

The Hondale-Mimbres-Bluepoint Association is found in broad, nearly level to very gently sloping basin floors and valley bottom (Figure19). The land is dissected only by a few shallow arroyos. Slightly higher sandy ridges of 1 to 3 feet break up the almost level topography. Deep soils of mixed origin comprise the basin fill. These soils had an accumulation of soluble salts but now they only contain a moderate to high content of exchangeable sodium (15).

Vegetation growing on these soils produce sparse to moderate cover. Maker, et. al., (15) report that dominant grasses include: Alkali sacaton (Sporobolus airoides), tobosa, vine mesquite (Panicum oblusum), burrograss, and desert saltgrass (Distichlis stricta). Mesquite, fourwing saltbush, shadscale (Atriplex confertifolia), tarbush, and rubber rabbitbrush (Chrysothamnus nauseosus) are shrubs found in this area.

These lands are primarily used for grazing. There is, however, a small portion of irrigated cropland in production. The salts in these soils have, however, caused problems in soil management.

Hondale soils are the most extensive soils found in this association and have a slope of 0 to 1 percent. The surface soils are light brownish-gray calcareous loam or silt loam. Subsoils consist of a thick light brown clay, underlain by light gray weakly stratified sand loams, sandy clay loams, and clay loams (15). The strongly alkaline soils have a moderate amount of exchangeable sodium or alkali. Areas devoid of vegetation contain high concentrations of sodium and are referred to as slick spots. Other characteristics of this soil are very slow permeability, a 7 inch available water holding capacity, and a moderate shrink-swell potential (Table 4).

The Hondale soils possess varying properties used in construction activities. Reservoir construction is recommended on these soils. These soils are not suited for use as topsoil, roadfill material, drainage fields for septic tanks, building construction, locating highways or locating sanitary landfills (Table 5).

Mimbres soils are also important in this association. They have a slope of 0 to 1 percent. The surface soils are moderately thick, light brownish-gray, silty clay loam or loam. Subsoils are pale brown silty clay loam or clay loam. Substratum weakly stratified loams, sandy clay loams, and clay loams of 5 feet or more typify the substratum (15). A moderate amount of exchangeable sodium is common in the subsoil and substratum of this series. These soils are also characterized by slow

permeability, 8 inches available water holding capacity, and a moderate shrink-swell potential (Table 4).

The Mimbres soils possess varying properties used in construction activities. These soils are not suited for use as topsoil, roadfill material, septic tank drainage fields, building construction, and locating highways or sanitary landfills. These soils are suitable for reservoir construction (Table 5).

Bluepoint soils are the least extensive of the important soil series found in this association. They occupy the slightly elevated and gently sloping ridges with a 0 to 3 percent slope. A discussion of these soils is found in association 1.

Other soils found in this association are: Maricopa, Berino, Pintura, and Simona series. A brown sandy surface layer and a 2 feet thick gravelly loamy sand subsoil are characteristic of the Maricopa soils (15). The Berino, Pintura, and Simona series are discussed in association 4.

APPENDIX D

A Preliminary Archaeological
Reconnaissance of the Proposed
Kilbourne Hole
Geothermal Area

INTRODUCTION

From January 30, 1975, to February 21, 1975, the Department of Sociology and Anthropology, Cultural Resources Management Division, New Mexico State University, conducted a preliminary archaeological reconnaissance of the proposed Kilbourne Hole Geothermal Area. The proposed geothermal area is in southwestern Dona Ana County, New Mexico and western Luna County, New Mexico (Map 1).

We knew that cultural resources were scattered throughout the area, but did not have enough data to predict high density zones. The purpose of the reconnaissance was to provide a superficial picture of site distributions in the geothermal area. The areas to be surveyed were not chosen statistically, but represented those areas where we had the least data. This report provides a general idea of where high site densities might be expected.

Three sites will be nominated to the National Register of Historic Places.

Patrick H. Beckett and Toni S. Murphy examined thirty-six transects and survey areas in fourteen field days. Additional information on site distribution was obtained from the files of the Museum of New Mexico and from amateur archaeologists in the Las Cruces area. The work was under the direction of Dr. Stanley D. Bussey, Department of Sociology and Anthropology, New Mexico State University.

It should be emphasized that this reconnaissance was not performed for archaeological clearance, but to provide data for future planning. Any modification of the surface should be preceded by a clearance survey of the affected area.

INTRODUCTION

From January 31, 1979, to February 15, 1979, the Department of Surveying and Engineering, [illegible] Management Division, [illegible] conducted a preliminary archaeological reconnaissance of the proposed [illegible] area. The [illegible] area for [illegible] Bureau area 11.

[illegible] throughout the area, [illegible]. The purpose of the reconnaissance was to provide a generalized picture of site distributions in the [illegible] area. The [illegible] were not chosen statistically, [illegible]. This report provides a general idea of [illegible].

[illegible] will be [illegible] to the National Register of Historic Places.

[illegible] and [illegible]. The work was under the direction of Dr. [illegible], Department of [illegible].

It should be emphasized that this reconnaissance was not [illegible], but [illegible]. [illegible] of the [illegible] should be [illegible] by a [illegible] of the [illegible] area.

GENERAL DISTRIBUTION OF CULTURAL RESOURCES

Fifteen previously unrecorded prehistoric sites were located in the project area during the reconnaissance. The archaeological team attempted to check as many environmental zones as possible in order to obtain a general idea of habitation patterns for the area. No attempt was made to survey the entire area or to perform an intensive survey in those areas which were checked. With one exception, areas for which we had some data were not revisited. Site and transect locations are recorded on the maps included at the end of this report. On most transects, there was scattered evidence of prehistoric occupation. This evidence consisted of occasional stone tools and flakes and scattered potsherds.

Areas of heavy site density include benches overlooking the Rio Grande, old playa lakes and sand dune areas near water sources. Particularly heavy densities will be found in the areas south and southwest of the East Potrillo Mountains, around the edges of playa lakes and natural tanks and the perimeter of Hunts and Kilbourne Holes.

Areas of low site density include those in which volcanic activity has left lava flows or heavy concentrations of basalt cobbles, such as the bases of the East Potrillo Mountains and the West Potrillo Mountains. Other low density areas are the bottoms of Hunts, Kilbourne and Phillips Holes and the basins of playa lakes and natural tanks.

PROTECTION OF CUTLTURAL RESOURCES

As long as there is some flexibility in the location of activities which modify the surface, there should be no difficulty in avoiding cultural

resources. In order to adequately protect cultural resources in the geothermal area, intensive surveys must be performed before any surface modification occurs.

This reconnaissance was not intended to provide the precise location of all cultural resoruces in the proposed Kilbourne Hole Geothermal Area. It was intended only to provide general information on the distribution of such resources. The fact that no sites were found in a particular transect does not mean that area is free of sites, but that the distribution is sparse. The Kilbourne Hole area is a particularly difficult one in which to work because of the large areas covered by sand dunes. Moving sand dunes can cover known cultural resources and uncover others in a matter of days. We strongly suspect that many sites have been covered by sand dunes in some areas.

To summarize, if adequate care is exercised, there should be no difficulty in avoiding and protecting cultural resources.

APPENDIX A

The Physiography of the Area

The Jornada area of the Mogollon which Lehmer (1948:72) linked to the Cochise culture is located in south-central New Mexico, extreme West Texas and north of the Villa Ahumada, Chihuahua.

The area is characterized by mountain ranges and basins. The mountain ranges generally lying on a north-south axis and the large basins lying between them. These basins after violent summer rainfalls, have numerous playas which hold water for varying lengths of time. The basins themselves are wide alluvial-filled valleys with an approximate elevation from 3000-5000 feet above mean sea level.

The mountains in the Jornada area are mostly fault block in origin with some igneous peaks. The survey area includes a number of small playas and lava flows, the most widespread flow being attributed to Aden Crater which produced a very large Malpais to the east. Evidence of Aden activity can be seen as far away as Phillips hole.

The area around Phillips hole is part of the Aden Crater flow and Phillips hole is probably a deflation area within the flow. Aden Crater probably dates between 20,000-200,000 years ago. Best estimate is around 100,000 years. (Personal communication William Seager 1975).

Two volcanic blowouts, Hunts hole and Kilbourne hole have left huge depressions in the ground. These volcanic blowouts are younger than Aden Crater. All the volcanic activity overlies the Camprice Formation which is late Pliocene to mid Pleistocene in origin.

Since the erosion cycle begain in the 1880's, there has been considerable dune activity in the basins. The formation of Coppice dunes (formed by brush

and vegetation acting in conflict with the wind Gile 1966) has been responsible for deflation of local soils.

The area is a marginal one for crops due to the low amount of rainfall in the Jornada del Muerto and other basins (less than nine inches a year). There is considerably more rain in the mountains due to orographic precipitation as the clouds are forced over the mountains. The main source of water is from lakes found in the basins during the summer and from springs which are usually located along the pediments.

The only major river running through the area is the Rio Grande, running from a north to south direction west of the San Andres Mountains. It borders the east edge of the survey areas.

The growing season in the mountains is from 80 to 175 days a year with an annual temperture from 40° to 52° F. The growing season in the basins is from 175-217 days a year, with an annual temperature of 56° to 63° F. Annual rainfall is from 8-12 inches a year (Lehmer 1948:11-13; Houghton 1972:3-5).

APPENDIX B

A Summary of the Prehistory of the Area

This brief summary of the area of south-central New Mexico is not intended to be exhaustive, but only to give a general idea of the local prehistoric sequence. For further information, see the books listed in the regular and supplementary bibliographies.

J. W. Fewkes was the first to publish on research in the area (Fewkes 1902). After that, there was no professional activity until the mid-1920's when H. S. and C. B. Cosgrove, working for the Peabody Museum, Harvard University, investigated the area (Cosgrove 1947). There followed a rash of published articles for the next two decades, culminated by Lehmer's work in the early 1940's and final publication, The Jornada Branch of the Mogollon (Lehmer 1948).

Most of the work which has been done since then can be attributed to the El Paso Archaeological Society, which has focused for the most part on the El Paso Phase of the Jornada Mogollon. It is due almost entirely to them that the El Paso Phase is so well known. The society has in the past lent its resources on various occasions to the professional expeditions in the area in the 1920's through the early 1940's.

More recently, work has been done by Hammack, "The Las Cruces Dam Site" (1963) Alexander, Archaeological and Historical Survey along New Mexico Highways (1966); Beckett and O'Laughlin, "Excavations of LA 5513" (1968); *Fitting, "The Burris Ranch Site, Dona Ana County, New Mexico" (1971)*; Beckett, "Gardner Springs Site" (1973); Greiser, "Preliminary Field Report

on the Findings and Results of the Evaluation of the Cultural and Historic Resources of the Las Cruces Arroyo Lithic Site" (1973); and Bussey's excavation at the Garfield Site (in preparation).

Archaeologically speaking, southern New Mexico has been one of the least understood parts of New Mexico, possibly because there are few spectacular ruins or monuments. However, the area did have a sizable population in the Archaic and Formative periods, when the geothermal survey area was occupied.

Th earliest humans in southern New Mexico seem to have been the Pleistocene big game hunters, such as the Clovis and Folsom cultures. The Clovis tradition is the earliest known for this area. These big-game hunters left few traces of their material culture. They had a well developed lithic technology, producing percussion flaked hunting points, and a bone tool technology. No structures are known for any of these early hunters. The lithic technology does not include any ground or polished stone artifacts.

The Clovis tradition is followed by the Folsom tradition. Their economy was based on the hunting of large herbivores, mostly an extinct species of bison.

Technologically, there is a change in projectile point manufacture; pressure flaking makes it first appearance.

The material culture inventory includes diagnostic fluted points, scrapers, including end-scrapers, thumbnail scrapers, turtleback scrapers and spokeshaves (a small concave scraper). In addition, leaf shaped knives, core choppers, and bone tools, such as awls and needles, are also part of the Folsom assemblage. Archaeological evidence indicates a population highly dependent on the hunting of big game.

As the Pleistocene gave way to the Holocene, the hunting cultures moved onto the Great Plains, following the percolation of the large game animals to a moister climate.

These big game hunters were replaced by hunters and gatherers who exploited an essentially modern environment. These hunters and gatherers were at an Archaic or Mesolithic level of development. The local Archaic tradition, called the Cochise, is one of many localized cultures which were adapted to the semi-arid western portions of North America. These western Archaic peoples are sometimes classified together as the Desert Culture. The Cochise tradition has been divided into three stages; the Sulphur Springs, Chiricahua, and San Pedro. In the Rio Grande Valley, the situation is somewhat complicated by influences from a poorly defined Archaic Tradition from West Texas. The term "Hueco" has been used for this tradition, but it has also been used for Late San Pedro Cochise, and for mixtures of the two. This complex situation should be resolved in a few years, but for the present, we will use the term "Hueco" for Late San Pedro Cochise.

Although they relied primarily on wild animals and plants, evidence of corn and squash has been found as early as the Chiricahua stage, and beans were used by the San Pedro stage (Dick 1965). However, the presence of some domesticated plants did not automatically lead to the development of a Formative or Neolithic way of life.

About 300 B.C., San Pedro Cochise peoples in southwestern New Mexico added pottery and settled villages to their cultural inventory and achieved a Formative level of development. The term Mogollon or Western Mogollon has been applied to these peoples. Those in the lower Rio Grande Valley have

As the Pleistocene gave way to the Holocene, [illegible] [illegible] the Great Plains, following the extinction of the large [illegible] animals of a colder climate.

These big game hunters were replaced by hunters and gatherers who [illegible] a seasonally varied environment. [illegible] [illegible] [illegible] level of development. The local [illegible] [illegible], called the Archaic, [illegible] one of many individual cultures which were adapted to the semi-arid western provinces of North America. These [illegible] Archaic peoples are sometimes collectively referred to as the Desert Culture. The Cochise [illegible] [illegible] stages [illegible] [illegible], Chiricahua, and San Pedro. [illegible] [illegible] [illegible] [illegible] Cochise [illegible] [illegible]. The term "Cochise" has been used for [illegible] [illegible] [illegible] [illegible] [illegible], and [illegible] [illegible], but [illegible] [illegible], we will use the term "Cochise" for [illegible].

Although they relied primarily on wild seeds and [illegible], evidence of corn and squash has been found as early as the Chiricahua stage, and beans were used by the San Pedro stage (Irwin 1967). However, [illegible] [illegible] [illegible] plants did not necessarily lead to the development of a [illegible] [illegible] way of life.

About 300 B.C., [illegible] Cochise peoples in [illegible] [illegible] the Mogollon [illegible] [illegible] [illegible] of their villages, pottery, and [illegible] a [illegible] level of [illegible]. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] Valley [illegible] been called Jornada Mogollon or Eastern Mogollon. They seem to have received many influences from the Western Mogollon, but were not identical in cultural inventories.

The basic work on the Jornada Mogollon was done by Donald Lehmer (1948). Lehmer divided the Jornada Mogollon into two regional variants, and divided each variant into three phases. The phases in this area are the Mesilla (earliest), Dona Ana and El Paso. For the most part, these are poorly known.

The archaeological remains found during the Geothermal Survey are very similar to those found in many areas of Southwestern New Mexico. This areas has been exploited by humans since the Clovis and Folsom big game hunting cultures. Thus, humans have been in the Jornada area for about 11,500 years.

After the start of the Altithermal, the climate became drier and hotter. This is perhaps why the Archaic tends to last longer in south central New Mexico, as this more hostile type of environment limited early attempts at horticulture.

Most sheltered and open sites with Archaic material in southwestern New Mexico contain manos and metates. These are characteristics of the Desert culture and the Cochise culture, lasting from the Sulphur Springs stage through the San Pedro and into the Mogollon development. Most shelters and caves have in close proximity a number of mortar holes, although these did not come into general use by the Cochise until San Pedro times. These artifacts indicate, at least in part, a gathering and food-processing economy as suggested by Lehmer.

> The evidence indicates a people at a comparatively low level of technological development; living in caves and open camps; planting some crops of corn, squash, and perhaps cotton; gathering wild food plants; hunting deer and small game with nets, snares, atlatls, and darts; having a fairly good technological development in wood, fibre, and stone; but lagging rather behind the inhabitants of the nuclear areas of the Southwest in other ways. (Lehmer 1947:73).

The inhabitants of southern New Mexico during the late Hueco time were practicing horticulture to some extent and were somewhat dependent upon its harvest. This dependence would have dictated a rather sedentary living for at least a small portion of the year. The environment becomes a very important element in this economic system since it places reliance on sufficient summer rains for the crops planted to mature. However, there is abundant evidence of hunting activities as there is lithic debris in a non-random pattern over benches overlooking the river and the characteristic mesa land cut by arroyos.

> The majority of these sites are situated on the banks of arroyos and the terraces of Pleistocene lakes. Sandy areas, especially dunes, were usually selected by these peoples for their campsites. The reasons for such selection are speculative, but the association of pre-ceramic campsites and sand is too common to be accidental. (Alexander 1966:17)

These Archaic hunters and gatherers preferred areas around sandy dune deposits.

> The pattern appears to be one of intermittently used sites, probably hunting camps. All sites are located along the edges of major arroyos on the gravel terraces usually in the dune sands which occur here. Artifacts are strictly lithic with only knapped and chipped stone implements being used. (Hammack 1963:5)

Very seldom is there a large concentration of lithics where a site is found. In LA 5529 (Beckett, 1973), a large number of food-processing tools were exposed, including manos, metates, along with points, knives, and scrapers.

> [illegible] (1969:[illegible])

The inhabitants of southern New Mexico during the late [illegible] horticulture [illegible] and were [illegible] dependent upon [illegible]. This dependence should have dictated a rather sedentary [illegible] at least a [illegible] portion of the year. The environment [illegible]. However, there is [illegible] evidence of hunting activities as there is little [illegible] in a [illegible] activity.

> The majority of these sites are situated on the [illegible] (1969:[illegible])

[illegible]

> [illegible] All sites are located along the edges of major [illegible] being used. ([illegible] 1969:[illegible])

Very seldom is there a large concentration of lithic waste [illegible] a site as found. In La Mesa (Bandelier, 1970), a large amount of [illegible] were exposed, [illegible], along with [illegible], [illegible], and [illegible]

The early dependence in this area upon gathering can be demonstrated by a 6400 ± 110 Before Present date of a hearth and associated metate from the Gardner Spring Site (Beckett, 1973). The early date of the metate suggests natural food processing was a factor at a relatively early date for the Jornada area. This would lend support to Lehmer's postulation of a basic "Cochise" pattern of traits for the area.

> It appears that the earliest stage(s) of the Jornada Branch was one crystalization of what might be considered a basic "Cochise" pattern--a complex of traits found in different forms in southern Arizona, southern New Mexico, and west Texas, and differentiated from other early southwestern cultures by a gathering rather than a hunting economy. This is indicated by the large numbers of milling stones found and the comparative infrequency of projectile points. (Lehmer 1948:72)

Lehmer's conclusion that the materials belong to a primarily gathering culture is due, in part, to his finding only three projectile points in his excavations at La Cueva. However, this amount is evidently due to the small size of the excavation. A more recent excavation in the talus slope at La Cueva by Thomas O'Laughlin (personal communication) has shown a yield in excess of one projectile point per 0.1 cubic meter of fill. If this holds true for the entire preceramic or Hueco Phase, then we must assume that hunting also played an intergral part of their daily activities.

There is no question of the importance of gathering in the economy and that it supplied a major portion of the inhabitant's dietary needs. However, hunting was also important judging by the large number of preceramic points, blades and scrapers found at La Cueva and at several other sites: The Burris Ranch Site (Fitting 1971); the Deming Ranchette Survey (Rose 1970); LA 5529 and LA 5531 (Beckett and O'Laughlin 1968). Hunting

of the local fauna evidently provides a high protein source. This dual relationship of hunting and gathering of local fauna and flora was necessary for the preservation of life in this semi-arid land.

From the existing data, it is probable that the Archaic population of southern New Mexico area was semi-nomadic and organized around kinship-based populations. Their subsistence techniques would be centralized around the flora and fauna potential of their geographical area, supplemented in late Hueco times or earlier by some cultivation centered around permanent water supplies. When their environment changed to allow improved agriculture potential, the local inhabitants began their change from a transient society to a sedentary one. These people, upon assuming a sedentary settlement pattern and agriculture, left the Hueco Phase (Late Archaic) and entered the Mesilla and Capitan Phases respectively of Lehmer's Jornada Branch of the Mogollon.

The Mesilla Phase marks the beginning of the Jornada Mogollon sequence and the beginning of the Formative Stage in the area. The stone assemblage of the Mesilla Phase is very similar to that of the preceding Hueco Phase. Plain brown pottery (El Paso Brown) and pit houses were among the items added to the cultural inventory (Lehmer 1948:46). Some Mesilla Phase sites have no foreign pottery, while others have trade pottery typical of the Western Mogollon. The trade pottery may have been imported from the west, or it may have come from the few Western Mogollon sites which are found along the Rio Grande. The time relationship between these 3 kinds of sites has not been worked out.

Mesilla Phase sites are probably present within the survey area and may be an early component of some of the sites recorded on the BLM Geothermal Survey.

The Dona Ana Phase is intermediate between the Mesilla and El Paso Phases. Formal excavation has been limited and insufficient in Dona Ana Phase sites; however, the data available indicates a direct carry-over of artifactual traits from the preceding phase. El Paso Brown pottery along with El Paso Bichrome and Polychrome are indigeneous. New intrusive ceramic types appear from the northwest and northeast and include Chupadiro black on white, Three Rivers Red on Terracotta and St. John's Polychrome.

Dona Ana Phase sites are characterized by pithouses in association with adobe-walled surface structures with adjacent rooms.

The El Paso Phase represents a high point in the confluence and formalization of already existing traits of the Dona Ana Phase. The El Paso Phase appears to be a direct outgrowth of the earlier horizon with the addition of a few minor traits to the later component. The exception to this is an expansion of trade relationships with surrounding areas represented by the increased number of intrusive ceramics found in El Paso Phase sites. Intrusive pottery found on these sites include Three Rivers Red on Terracotta, Chupadero black on white, Gila Polychrome, Agua Fria glaze on red (Glaze I), St. Johns' Polychrome, Playas Red and other Chihuahuan wares. El Paso Brown pottery is indigeneous, with El Paso Polychrome being the most abundant style.

El Paso Phase villages are characterized by adobe-walled surface structures in linear clusters oriented in an east-west direction or grouped around plazas.

It is probably safe to say that the Early Historic population of the lower Rio Grande Valley derive from the El Paso Phase, although it would be difficult to prove this at the present time.

APPENDIX C

The Sites and Their Distribution

Introduction

A total of fifteen previously unrecorded prehistoric sites was recorded within the survey area. LA 2805, a previously recorded site, was revisited. All of the sites are representative of the Jornada Branch of the Western Mogollon (El Paso Expression) with the possible exceptions of Sites GS 1, GS 14 and LA 2805. Artifactual indications on the surface of GS 1 and GS 14 show affinities to the Cochise Culture (see Appendix B).

Architectural remnants of semi-subterranean room clusters with rubble masonry may indicate that LA 2805 is a late Mimbres Phase, Mogollon pueblo. However the broad base of indigenous and intrusive ceramic evidence also indicates that LA 2805 is multicomponent, and that occupation continued beyond the Mimbres phase.

Field numbers were assigned to each site recorded, using the code GS (Geothermal Survey) and sequential numbers as each new site was found (e.g., GS 1, GS 2,...). Copies of the survey forms will be sent to the Museum of New Mexico and each site will be assigned a Laboratory of Anthropology (LA) number.

The Sites

Site GS 1

Location: The site is located in the NE¼ of the SE¼ of Section 32, Township 27 South, Range 1 West in Dona Ana County, New Mexico; on the south south east rim of Hunt's Hole. (Property owned by the State of New Mexico.)

This site is 100 by 300 meters, lying in blown out areas of a sandy ridge. The surface of the site is uneven and slopes to the northwest. Primary drainage is internal into Hunt's Hole, this being a confluence and the major source of water. Semiarid vegetation patterns include creosote and mesquite in abundance, yucca, bunch grass, ephedra and canaigre.

The site is eroded and damaged by pot-hunting. Cultural debris is scattered throughout the area. Stone artifacts from the site consist of a spokeshave, side scrapers and debitage (waste flakes). Traces of one hearth were noted.

Comments: The lithic material observed on GS 1 indicates an affinity to the Archaic Cochise Culture.

Site GS 2

Location: This site is located in the NE¼ of the SW¼ of the NE¼ of Section 31, Township 27 South, Range 1 West in Dona Ana County, New Mexico; on the southwest rim of Hunt's Hole.

This site is 50 by 50 meters, lying in the eroded blown out areas of a cliff's edge. The sandy surface is level and slopes to the northeast. The primary drainage is internal, into Hunt's Hole. The water source is a confluence one-quarter mile northeast of the site with the nearest arable land being one-quarter mile northeast in the bottom of Hunt's Hole. Local vegetation patterns include creosote in abundance, mesquite, ephedra, saltbush, canaigre and yucca.

This site consists of a scattered sherd and chipping area. No discernible architectural features were noted with the exception of minor traces of a hearth.

The ceramic evidence (abundance in the hundreds) observed on this site shows a notable amount of Jornada Brown ware and El Paso Brown ware and lesser quantities of Playas Plain Red Ware and Cloverdale Punctate (smudged interior).

Stone artifacts from the site consist of a scraper plane, a chopper and debitage. Found on this site, but not a component of it, were two diagnostic tools, a side scraper and spokeshave, indicating traces of Paleoindian occupation.

Comments: The ceramic material observed on this site indicates a late occupation (1300 A.D.) of the Jornada Mogollon. The presence of the intrusive Chihuahuan Wares (Playas Red) indicates contact with the cultures of northern Mexico and the possibility of a multicomponent site.

Site GS 3

Location: This site is located in the SE¼ of the SW¼ of the NW¼ of Section 29, Township 27 South, Range 1 West in Dona Ana County, New Mexico; on the north rim of Hunt's Hole.

This site is 20 by 20 meters, lying in the eroded, blown out sandy surface of a cliff's edge. The primary drainage is internal into Hunt's Hole. The water source is a confluence one-quarter mile south in the bottom of Hunt's Hole with the nearest arable land being one-quarter mile south of the site in the bottom of Hunt's Hole. Vegetation patterns include mesquite, creosote, ephedra, canaigre, yucca and bunch grass.

This site shows evidence of pot-hunting; however, substantial quantities of Jornada Brown Ware (abundance in the tens) was found scattered throughout the site.

No stone artifacts or architectural features were found within the site.

Comments: This site has been designated as Jornada Mogollon based on the indigenous ceramic material observed. The lack of features and stone artifacts is accounted for by recent aeolian activity in this area and, possibly, by vandalism.

Site GS 4

Location: This site is located in the SE¼ of the NW¼ of the SW¼ of Section 17, Township 27 South, Range 1 West in Dona Ana County, New Mexico; 10 meters due south of the access road on the south rim of Kilbourne Hole.

This site is 20 by 20 meters, located in a blowout on a gravelly/sandy slope (north-south axis). The primary drainage is internal into Kilbourne Hole. The confluence and nearest arable land is one mile north of the site, in the bottom of Kilbourne Hole. Local vegetation patterns include creosote in abundance, mesquite, yucca, bunch grass and ephedra.

The ceramics observed (in the 30's) from this site include Jornada Brown Ware and in lesser quantities, Jornada Bichrome and El Paso Brown Ware.

Stone artifacts from this site consist of a few waste flakes. No diagnostic tools or surface structures were noted.

Comments: Indigenous ceramics from this site indicate an affinity with the Jornada Mogollon.

Site GS 5

Location: This site is located in the SE¼ of the SW¼ of the NE¼ of Section 18, Township 27 South, Range 1 West in Dona Ana County, New Mexico; on the west rim of Kilbourne Hole within 10 meters of the cliff edge. Access road cuts through this site.

This site is 50 by 50 meters, located in a blowout on a slope (east-west axis) not more than ten meters from the cliff edge. The surface is level and covered with sand and gravel. The primary drainage is internal into Kilbourne Hole. The confluence and nearest arable land is 1¼ mile northeast of the site, in the bottom of Kilbourne Hole. Local vegetation includes creosote, mesquite, ephedra, yucca and saltbush.

The ceramics (abundance in the 100's) observed on this site indicate a majority of Jornada Brown Ware and in small quantities, El Paso Brown Ware, Cloverdale Punctate (smudged interior) and Playas Plain Red Ware.

Stone artifacts include a scraper and debitage (abundance in the 10's).

No architectural features were noted with the exception of a mortar, located in a basalt outcrop 80 meters west from the site's center.

Comments: This site has been designated as Jornada Mogollon. The possibility of a late component (or multicomponent) site is indicated by traces of the two intrusive ceramic types of Cloverdale Red and Playas Plain Red. This also demonstrates contact with cultures outside of the Jornada culture area.

Site GS 6

Location: This site is located in the NW¼ of the SW¼ of the NE¼ of Section 12, Township 29 South, Range 2 West in Dona Ana County, New Mexico; northwest of the abandoned town of Potrillo; north of the BLM access road and abandoned Southern Pacific Railroad tracks and west of the access road into the East Potrillo Mountains (at the junction of these two roads).

This site is 30 (E/W) by 20 (N/S) meters and lies on the eroded surface of gently sloping (to the south) flat land. The surface deposits are aeolian and consist of sand and gravel. The primary drainage is to the south and east; the source of water is unknown. The nearest arable land is located in a volcanic blowout, 1¼ mile southeast of this site. Local vegetation patterns include creosote and mesquite in abundance, saltbush and yucca.

Ceramics (abundance in the 300's) on this site consist of Jornada Brown Ware and El Paso Brown Ware with traces of Playas Plain Red Ware.

Stone artifacts were limited, and included one scraper plane and a small quantity (in the 10's) of utilized flakes.

No architectural features were noted.

Comments: This site has been designated as Jornada Mogollon, based on the excessive quantities of Jornada and El Paso Brown Wares. The intrusive Playas Plain Red may indicate a late component at this site.

Site GS 7

Location: This site is located in the NW¼ of the NE¼ of the NE¼ of Section 12, Township 29 South, Range 2 West in Dona Ana County, New Mexico. The access road into the southern area of the East Potrillo Mountains cuts through the site.

This site is 20 by 20 meters and is located on a road cut blown over with sand. The primary drainage in the vicinity of the site is to the east, water source and nearest arable land are unknown. Local vegetation includes mesquite in abundance, saltbush, Russian thistle, snakegrass and yucca. Coppice dune build-up is quite notable in this area.

Ceramic evidence (abundance in the 10's) included only Jornada Brown Ware.

Stone artifacts from the site consist of a spokeshave, side scraper, mano and a blade.

No architectural features were noted.

Comments: Indigenous ceramics from this site indicate an affinity with the Jornada Mogollon.

Site GS 8

Location: This site is located in the NE¼ of the SE¼ of the SE¼ of Section 1, Township 29 South, Range 2 West in Dona Àna County, New Mexico; on the east side of the access road going north into the East Potrillo Mountains, approximately one mile from the junction of the access road and the El Paso to Columbus BLM road.

This site is 150 (E/W) by 100 (N/S) meters and is located in a blown out area surrounded by Coppice dunes. Sandy, aeolian deposits are predominant. Primary drainage in the vicinity of the site is to the east; water source and nearest arable land are unknown. Vegetation pattern includes mesquite in abundance, Russian thistle, saltbush and yucca.

Ceramics (abundance in the 100's) observed included Jornada Brown Ware and lesser quantities of Jornada Bichrome, Playas Plain Red Ware, Playas Red Incised, and Chihuahuan Brown Wares (plain and tooled). One

sherd of Mimbres Classic Black-on-White was found.

Stone artifacts (abundance in the 10's) consisted of a mano and utilized flakes.

No architectural features were noted.

Comments: The presence of substantial amounts of Jornada Brown Ware would indicate a Jornada Mogollon occupation. The intrusive ceramics, Chihuahuan Red and Brown Wares and the Mimbres Classic sherd, may be representative of a late component in this site as well as contact with northern Mexico and the western Mogollon subarea.

This site will be nominated to the National Register of Historic Places.

Site GS 9

Location: This site is located in the SW¼ of the NE¼ of the SW¼ of Section 6, Township 29 South, Range 1 West in Dona Ana County, New Mexico; 525 meters east of the access road to the southern area of the East Potrillo Mountains.

This site is 10 by 10 meters and is located in a blowout on a sheetwash, gently sloping to the east. Coppice dunes and sandy aeolian deposits surround the vicinity of the site. Primary drainage is to the east; seasonal water may occur in an arroyo one mile north of the site. The nearest arable land is unknown. Local vegetation patterns include mesquite in abundance, yucca, saltbush, Russian thistle and snakebush.

Ceramics (abundance in the 150's) are predominantly Jornada Brown Ware and traces of Jornada Bichrome.

Stone artifacts include a side scraper and debitage.

No architectural features were noted.

Comments: The abundance of Jornada Brown Ware indicates a Jornada Mogollon occupation.

Site GS 10

Location: This site is located in the SE¼ of the NW¼ of the SW¼ of Section 6, Township 29 South, Range 1 West in Dona Ana County, New Mexico; 400 meters east of the access road to the southern area of the East Potrillo Mountains.

This site is 10 by 10 meters and is located in a blowout surrounded by coppice dunes and aeolian deposited sand. The primary drainage in the site's vicinity is to the east off of gently sloping flatland. Seasonal water may occur in an arroyo, 3/4 mile north of the site. The nearest arable land is unknown. Vegetation patterns include mesquite in abundance, saltbush, Russian thistle, snakebush and yucca.

Ceramic evidence (abundance in the 10's) observed included only Jornada Brown Ware and traces of Jornada Bichrome.

Stone artifacts and architectural features were not noted on this site.

Comments: Indigenous ceramics from this site indicate an affinity with the Jornada Mogollon.

Site GS 11

Location: This site is located in the SE¼ of the NW¼ of the NW¼ of Section 5, Township 29 South, Range 1 West in Dona Ana County, New Mexico; 1 3/4 miles north of the El Paso to Columbus BLM road; one mile southeast of the southern portion of the East Potrillo Mountains; in a zone between the creosote and mesquite on the east side of a

ridge base.

This site is 5 by 5 meters and may only represent a sherd area. It is located in a blowout situated on a slope (east-west axis). Coppice dunes and aeolian deposited sand surround the site. The primary drainage is to the east, seasonal water may occur in an arroyo 3/4 miles to the northwest of the site. The nearest arable land is unknown. Local vegetation patterns include creosote in abundance, mesquite, saltbush, snakebush and yucca.

Ceramics (abundance in the 10's) on this site consist of Jornada Brown Ware.

Stone artifacts include a side scraper, spokeshave and several utilized flakes.

No architectural features were noted.

Comments: Indigenous ceramics from this site indicate an affinity with the Jornada Mogollon.

Site GS 12

Location: This site is located in the NE¼ of the SE¼ of the NE¼ of Section 24, Township 28 South, Range 1 East in Dona Ana County, New Mexico; access road passes by the site exactly five miles southwest of the Southern Pacific Railroad tracks.

This site is 10 by 10 meters and is located in a blowout situated on a ridge. The area is surrounded by coppice dunes and aeolian deposited sand. The primary drainage and confluence are to the southwest of the site. Nearest arable land is in a depression one-quarter mile to the southwest. Vegetation patterns include mesquite in abundance, saltbush, snakebush and yucca.

Ceramics (abundance in the 10's) on this site consist of Jornada Brown Ware.

No stone artifacts were noted, with the exception of debitage in minor quantities.

No architectural features were noted.

Comments: Indigenous ceramics from this site indicate an affinity with the Jornada Mogollon.

Site GS 13

Location: This site is located in the SW¼ of the SW¼ of the NW¼ of Section 6, Township 29 South, Range 2 West in Dona Ana County, New Mexico; one-half mile west of abandoned Mt. Riley; between the old Southern Pacific rail bed and a bench, due south of the rail bed.

This site is 10 by 10 meters and is located on a slope (north-south axis). The surface is uneven and covered with gravel and wind blown sand. The primary drainage flows north to the track bed, then turns west into a low basin. Confluence and nearest arable land lie one-half mile to the west of the site. Local vegetation patterns include mesquite, saltbush, snakebush, Russian thistle, creosote and yucca.

Ceramics (abundance in the 30's) on this site include Jornada Brown Ware and lesser quantities of Playas Plain Red Ware and Playas Red Punctate.

Stone artifacts consist only of a scraper and debitage. An area approximately 50 meters west of the site showed scattered cultural debris including metate and mano fragments and utilized flakes.

No architectural features were noted.

Comments: This site has been designated as Jornada Mogollon. The presence of Chihuahuan Red Wares indicates contact outside of the Jornada culture area and possibly a late component in the site.

Site GS 14

Location: This site is located in the NW¼ of the NW¼ of the NW¼ of Section 6, Township 29 South, Range 2 West in Dona Ana County, New Mexico; one-half mile northwest of abandoned Mt. Riley.

This site is 20 by 20 meters and is located on top of the northeast portion of a small hill, overlooking a major drainage basin to the west. The blownout, level surface slopes to the east and is covered with rock and wind blown sand. A minor build up of coppice dunes occurs on the hill. The primary drainage in the vicinity of the site flows to the east. The confluence is one mile from the site. The nearest arable land lies to the southwest. Local vegetation patterns in the area are sparse, consisting of mesquite, creosote, saltbush and some yucca.

No ceramics were noted.

Stone artifacts (abundance in the 90's) include a mano, blades, utilized flakes, side scrapers, and a spokeshave.

No architectural features were noted.

Comments: The cultural designation of this site is complicated by the absence of ceramics and the lack of diagnostic tool types. The artifact assemblage present on the site may indicate affinity to the Archaic Cochise Culture. Without further observation and/or excavation, this affinity cannot be substantiated.

Site GS 15

Location: This site is located in the SE¼ of the NW¼ of Section 1, Township 29 South, Range 2 West in Dona Ana County, New Mexico; southwest of the access road which runs northwest from the El Paso to Columbus BLM road.

This site is 600 by 400 meters and is located on a bench. The site lies in the blown-out areas of a level surface, surrounded by coppice dunes and aeolian deposited sand. The primary drainage in the vicinity flows to the north. The confluence and nearest arable land is one-half mile north of the site. The local vegetation pattern includes mesquite, saltbush and yucca in abundance, snakebush, ephedra and one cholla.

The pottery/artifact abundance found on this site numbered in the 10,000's and is scattered throughout the entire area of the site. There is a good possibility that two or more habitation areas may be included within the area of the site. However, coppice dune build up and aeolian activity have hidden evidence to this effect, and formal excavation would be necessary in order to delineate the situation.

Ceramic evidence observed on this site is characterized by large amounts of Jornada Brown Ware and lesser quantities of El Paso Brown Ware, Jornada Bichrome, Chihuahuan Brown Wares, Playas Plain Red Ware, Playas Red Incised, Cloverdale Red Punctate (smudged interior), Mimbres Classic Black-on-White, Chupadero Black-on-White, and one sherd of St. John's Polychrome.

Stone artifacts consist of manos, metate fragments, side scrapers, retouched and utilized flakes and one scraper plane.

No architectural features were noted.

Comments: This site has been designated as Jornada Mogollon. Surface evidence indicates a late occupation (1200 - 1250 A.D.) and the possibility

of a multicomponent site. The presence of a substantial variety of intrusive ceramics represents considerable contact with the northern Jornada and northern Mexico culture areas, the western Mogollon subarea, and the Little Colorado culture center.

This site will be nominated to the National Register of Historic Places.

Site LA 2805 (resurvey)

-Recorded by H.W. Yeo (site C 223), ca. 1950

Location: This site is located in the NW¼ of the SW¼ of Section 32, Township 24 South, Range 4 West in Dona Ana County, New Mexico; on the west side at the base of Rattlesnake Mountain (property owned by the State of New Mexico).

This habitation site is 50 by 100 meters and is located on a slope. The uneven surface is rocky and covered with aeolian deposited sand. The primary drainage is to the south. The major source of water is a confluence in the south and a spring located on the northeast side of Rattlesnake Mountain. The nearest arable land is one-half mile from the site on the east side of Rattlesnake Mountain. Local vegetation patterns include creosote and mesquite in abundance, yucca, canaigre, snakebush and wild grasses.

This site is badly pot-hunted; cultural debris, room fill and building materials are scattered throughout the area.

Architectural remains indicate semi-subterranean room clusters with rubble masonry. Room fill consists of aeolian deposited sand of approximately 50 centimeters.

Ceramics observed on the site include Alma Plain, Mangus Black-on-White, Mimbres Classic Black-on-White, Mimbres Corrugated, and lesser

quantities of Jornada and El Paso Brown Ware, Playas Plain Red Ware, Playas Red Incised and Chupadero Black-on-White.

Stone artifacts consist of utilized and retouched flakes, cores, blades, a graver and a mano.

Approximately one-quarter and three-quarter of a mile due west of the site are two multiple useage areas. Both are characterized by a large number of mortar holes and axe sharpening depressions in the basalt outcroppings. One petroglyph noted on the extreme west area.

Comments: The architectural evidence indicates a late Mimbres Phase occupation. However, the presence of Chihuahuan ceramics is substantial evidence for a multicomponent site. Excessive amounts of intrusive ceramics also represents considerable contact with the northern and southern Jornada Culture area as well as with northern Mexico.

This site will be nominated to the National Register of Historic Places.

APPENDIX D

Site Locations

UNITED STATES
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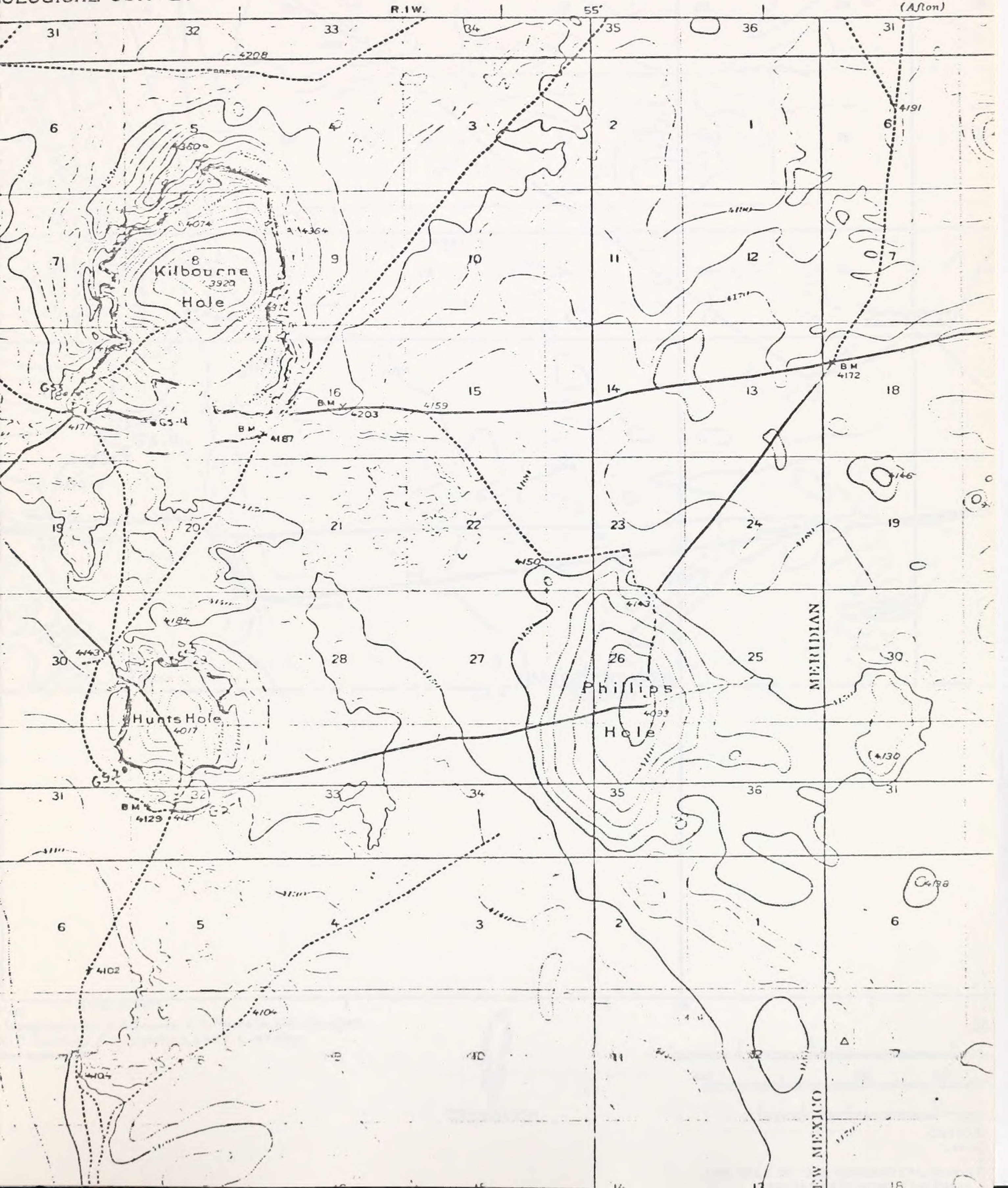
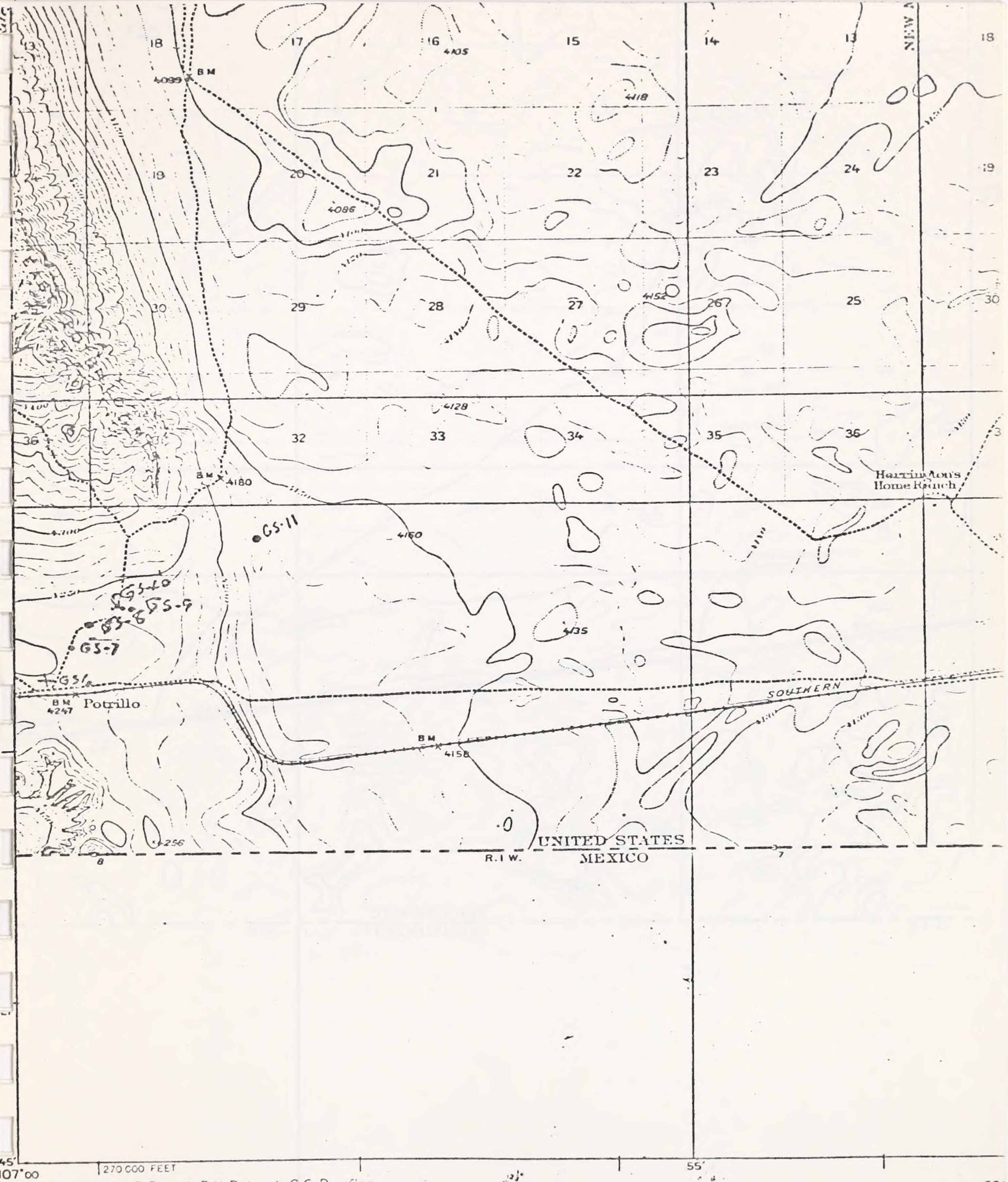
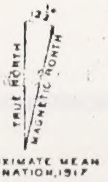
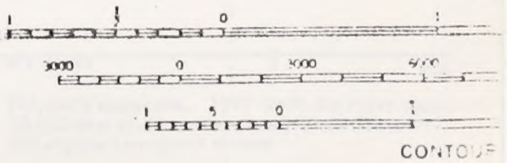
UNITED STATES
DEPARTMENT OF THE
CORPS OF ENGINE





Topography by J.G.Staack, R.H.Reineck, G.C.Douglas,
C.C.Gardner, F.A.Danforth, and F.L.Whaley
Surveyed in 1917





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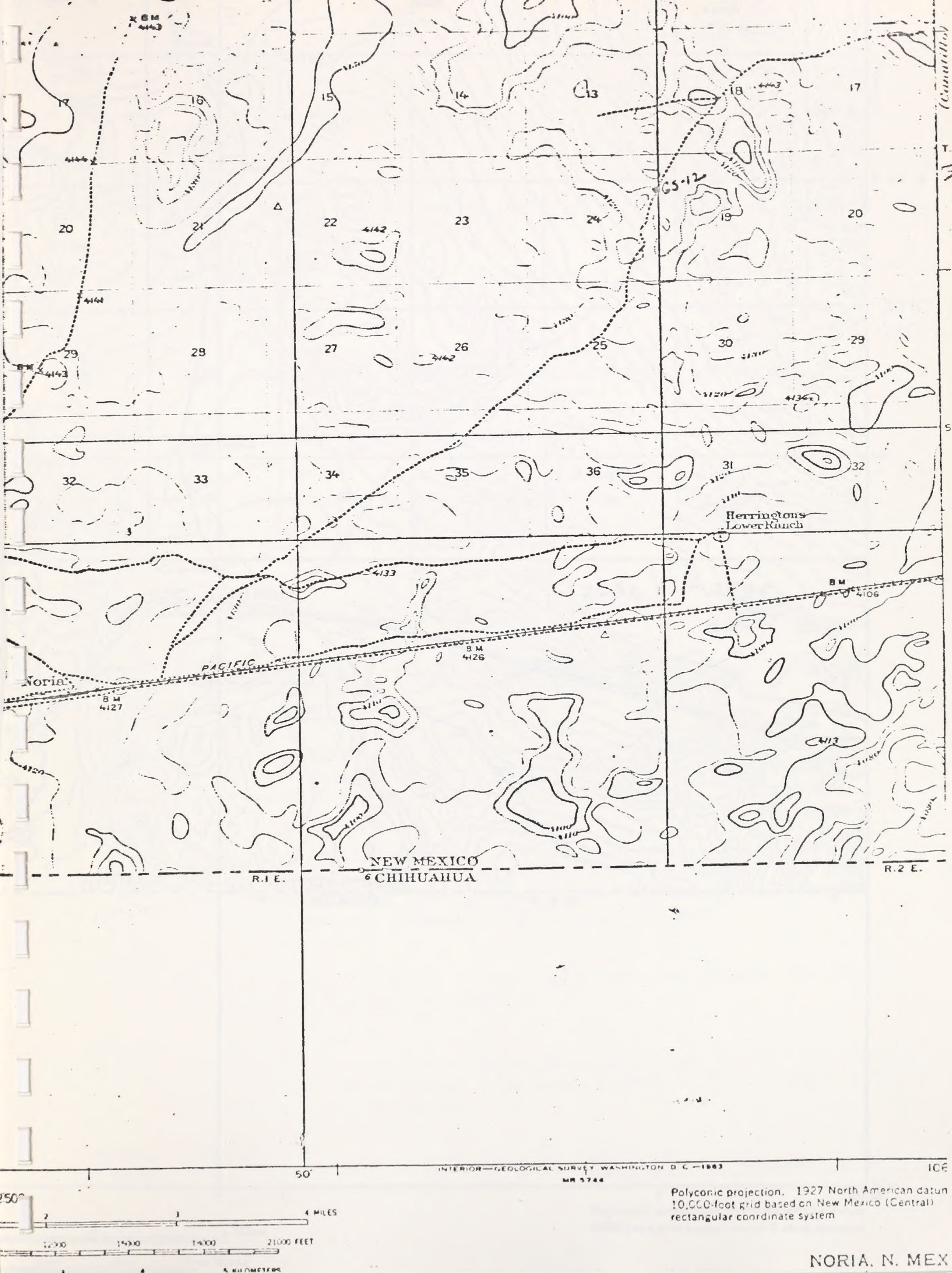
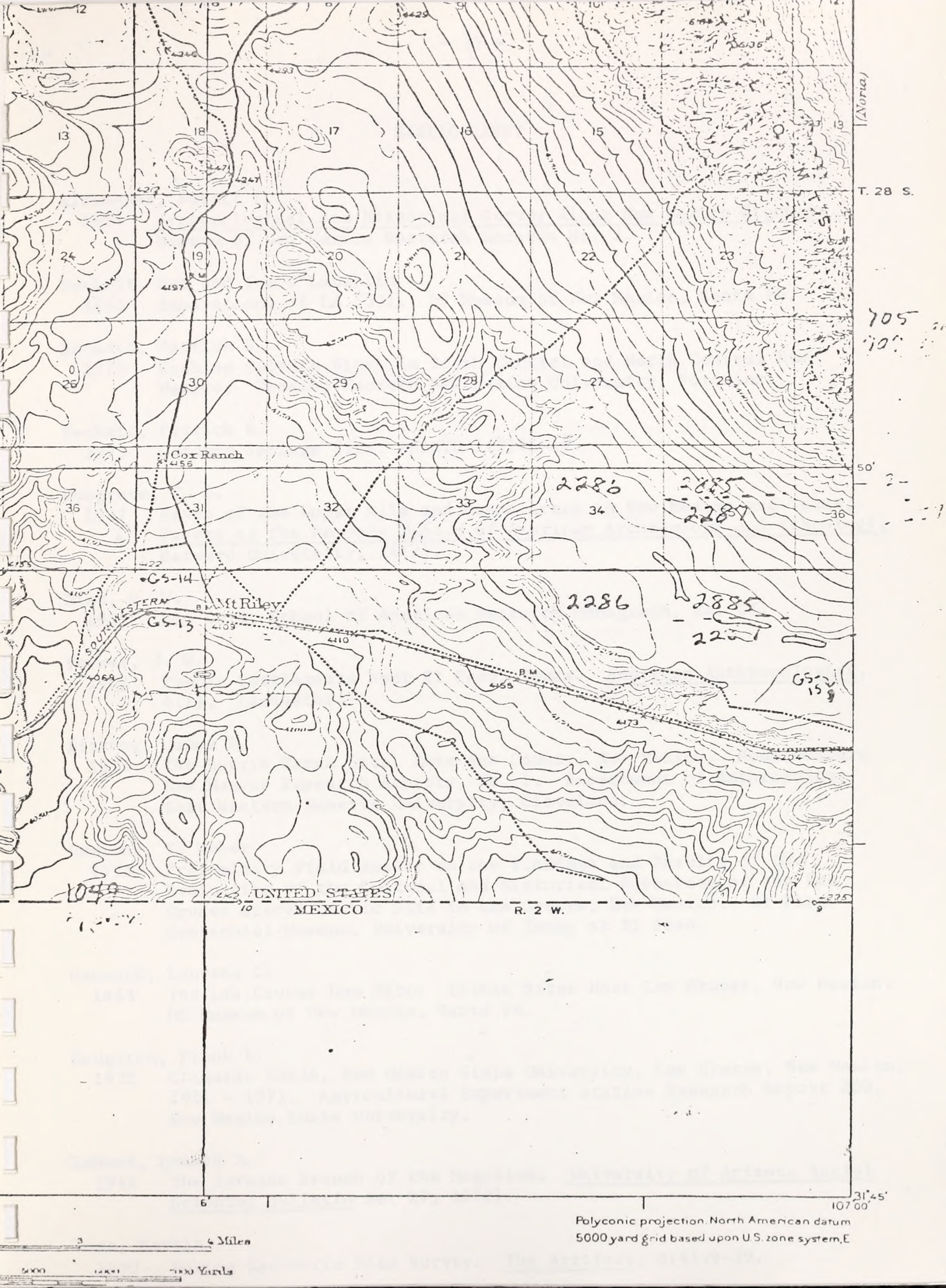


INTERIOR—GEOLOGICAL SURVEY WASHINGTON D C—1963
MR 5744

Polyconic projection. 1927 North American datum
10,000-foot grid based on New Mexico (Central)
rectangular coordinate system

NORIA, N. MEX.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Mt Riley
SOUTHWESTERN
GS-14
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R. 2 W.
1049
31°45'
107°00'
Polyconic projection. North American datum
5000 yard grid based upon U.S. zone system, E
Miles
Yards

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APPENDIX E

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

GEOTHERMAL RESOURCES OPERATIONAL ORDER NO. 1

Effective February 1, 1975

EXPLORATORY OPERATIONS

This Order is established pursuant to the authority prescribed in 30 CFR 270.11 and in accordance with 30 CFR 270.78. All exploratory operations other than drilling of exploratory and development wells will be conducted in accordance with the provisions of this Order. All plans for exploratory operations to be conducted shall include provisions for appropriate environmental protection and reclamation of disturbed lands. A cultural resources investigation approved by the Area Geothermal Supervisor (Supervisor) shall be performed prior to any surface disturbance other than casual use.

All variances from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 270.48. Each Notice of Intent to Conduct Geothermal Resources Exploration Operations shall include a notation of any proposed variances from the requirements of this Order. References in this Order to approvals, determinations, or requirements are to those given or made by the Supervisor or his delegated representative.

The following exploratory operations and reasonable expenditures therefore will qualify as diligent exploration if approved by the Supervisor prior to the initiation of such operations.

1. Casual Use. Casual use shall include any entrance on the leased lands for geological reconnaissance or surveying purposes. Sampling of springs and water wells on the lease for geochemical analysis shall be construed as casual use. Such non-disturbing surveys and reconnaissance operations will not require a Notice of Intent to Conduct Geothermal Resources Exploration Operations. The lessee shall notify the Supervisor prior to commencing such casual use operations. Casual use operations proposed or completed shall be included in any subsequent Plan of Operations.

2. Geophysical Exploration. Geophysical exploration shall include, but is not limited to, surface electrical resistivity surveys, seismic ground noise surveys, passive micro-earthquake monitoring surveys, magneto-telluric surveys and all other geophysical surveys, including airborne techniques.

Geophysical surveys other than airborne techniques will require a Notice of Intent to Conduct Geothermal Resources Exploration Operations (Form 3200-9). All such anticipated surveys should be included in the Plan of Operations and must be approved by the Supervisor before the work is begun.

The lessee shall furnish the Supervisor two copies of the records of such surveys within 30 days after the completion of such operations.

3. Drilling of Shallow Holes. Drilling of shallow holes for the measurement of temperature gradients or heat flow will be considered as an exploration operation and will require approval of a Notice of Intent to Conduct Geothermal Resource Exploration Operations (Form 3200-9) by the Supervisor. The following stipulations shall apply to the drilling of such shallow holes:

A. Holes for measuring temperature gradients shall be limited to a depth of 152 metres (500 feet), unless otherwise authorized by the Supervisor.

B. Return-line temperatures shall be taken at no less than 9-metre (30-foot) intervals during drilling operations on shallow holes drilled with mud. If return-line mud temperature should reach 52°C (125°F), drilling ahead shall cease immediately and the hole will be either

(1) completed as an observation hole by running steel tubing as deep as possible, filling the annulus with drilling mud from total depth to 3 metres (10 feet) below the surface and with cement from 3 metres (10 feet) to the surface;

(2) abandoned by filling the hole with drilling mud from total depth to 3 metres (10 feet) below the surface and cement to the surface thereafter, or

(3) equipped with mud cooling and wellhead control devices to maintain well control and mud returns temperature at or below 52° C (125°F).

C. If flowing steam or hot water at 65°C (150°F) or greater is encountered, further drilling shall stop immediately and the hole will be either

(1) completed as an observation hole using steel tubing cemented from total depth to surface; or

(2) abandoned by plugging with cement from total depth to surface.

D. If cold flowing artesian water is encountered, the hole will be completed as in (C) hereinabove, except that plastic tubing may be used.

If the conditions outlines in (B), (C) or (D) are encountered, the Supervisor shall be notified immediately.

No exceptions to the stipulations of (B), (C) or (D) will be allowed without the specific prior permission of the Supervisor.

E. The lessee shall submit the following information with the Notice of Intent to Conduct Geothermal Resources Exploration Operations (Form 3200-9):

(1) The approximate location (to the nearest 30 metres (100 feet) from some identifiable marker or object within the smallest legal subdivision) and hole number or designation of each proposed hole and probable order of drilling;

(2) The type and size of drilling rig;

(3) The proposed drilling program including the drilling system (type of bit and circulating medium), approximate depths and casing (conductor) program for each such hole;

(4) The type of drilling sump and proposed method of sump abandonment at each location;

(5) The approximate time that each hole will be used for observation; and

(6) The proposed method of abandonment for each hole. Additionally, the lessee shall notify and receive the approval of the Supervisor prior to any change in the location of an approved hole or for any additional holes which the lessee desires to drill.

F. Locations proposed in natural thermal areas within a 300-metre (1,000-foot) radius of hot springs, fumaroles, or other surface geothermal indicia, or in areas of known artesian water flow, will require a detailed drilling program for each hole, approved by the Supervisor. The Supervisor may require special drilling and completion techniques for such holes (such as cemented surface casing and simple expansion-type blowout preventers) to safely control formations containing geothermal or other resources which may be penetrated.

G. A supply of mud and lost circulation material shall be kept on hand while drilling to control abnormal pressure if rotary equipment is used.

H. Holes shall be completed for observation purposes in a manner which will allow satisfactory subsequent abandonment. As a minimum, the annular space shall be filled with mud (cuttings and dirt if drilled with air or auger) to 3 metres (10 feet) below the surface and with cement from 3 metres (10 feet) to the surface, and the tubing shall be capped when not in use.

I. Holes shall be abandoned in a manner that will prevent subsurface inter-zonal migration of fluids and surface leakate. As a minimum, the top 3 metres (10 feet) of tubing below the surface shall

be filled with cemet. Tubing shall be cut off at ground level or as directed by the Supervisor.

4. Reporting Completion of Exploration Operations. The Notice of Completion of Geothermal Resources Exploration Operations (Form 3200-10) shall be submitted in triplicate, and shall include the following information for each hole drilled:

A. Final hole designation and location;

B. A driller's log noting water table and water aquifers encountered (if determined), and salt, coal beds or other mineral deposits, if present;

C. Method of completion, cementing, and casing and/or tubing used;

D. Complete details of the abandonment procedures;

E. Any information on drilling difficulties or unusual circumstances encountered which would be helpful in assuring future safety of operations or protection of the environment in the area concerned; and

F. Temperature data and logs for each hole surveyed.

5. General. Drilling fluids or cuttings shall not be discharged onto the surface where such discharge might contaminate lakes and pernnial or intermittent streams. Excavated pits or sumps used in drilling shall be backfilled as soon as drilling is completed and restored to conform with the original topography. Unattended sumps shall be completely fenced for the protection of the public, domestic animals and wildlife.

6. Notice of Entry. Applicant shall contact the appropriate U.S. Geological Survey Geothermal District Office prior to entry on the land to conduct exploration operations.

Reid T. Stone
Area Geothermal Supervisor

APPROVED:

Russell G. Wayland
Chief, Conservation Division

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

GEOTHERMAL RESOURCES OPERATIONAL ORDER NO. 2

Effective February 1, 1975

DRILLING, COMPLETION AND SPACING OF GEOTHERMAL WELLS

This Order is established pursuant to the authority prescribed in 30 CFR 270.11 and in accordance with 30 CFR 27014, 270.15, and 270.40. All wells shall be drilled in such a manner as to minimize damage to the environment and to protect life, health, property, usable ground waters and geothermal resources.

All exploratory wells drilled for geothermal resources shall be drilled in accordance with the provisions of this Order. Initial development wells drilled for geothermal resources shall be drilled in accordance with the provisions of this Order, and these provisions shall continue in effect until field rules are issued. After field rules have been established by the Area Geothermal Supervisor, development wells in the individual fields shall be drilled in accordance with such rules.

Where sufficient geologic and engineering information is obtained through exploratory drilling, lessees may make application or the Supervisor may request the lessee to submit an application

for the establishment of field rules. The Supervisor may issue field rules at any time he deems appropriate upon failure of the lessee to timely file for such field rules.

All wells drilled under the provisions of this Order shall have been included in an exploratory or development Plan of Operations as required under 30 CFR 270.34. Each Application for Permit to Drill (Form 9-331C) shall include all information required under 30 CFR 270.71, and shall include a notation of any proposed variances from the requirements of this Order. All variances from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 270.48. References in this Order to approvals, determinations, and requirements for submitting of information or applications for approval are to those granted, made or required by the Supervisor or his delegated representative. The lessee shall comply with the following requirements:

1. Well Casing. All wells shall be cased and cemented in accordance with the requirements of 30 CFR 270.15, and the application for permit to drill shall include the casing design safety factors for collapse, tension and burst. The permanent wellhead completion equipment shall be attached to the production casing or to the intermediate casing if the production casing does not reach to the surface except as otherwise authorized by the Supervisor to meet special well conditions. All casing strings reaching the surface shall be cemented at a sufficient depth to provide adequate anchorage and support for the casing and any blowout prevention equipment required thereon. For the purpose of this Order, the several casing strings in order of normal installation are (1) conductor, (2) surface, (3) intermediate and

(4) production strings. The following casing setting depth requirements are general in nature and subject to variations to permit the casing to be set and cemented in a competent formation. The Supervisor's determination of adequate casing setting depths shall be based upon all geologic and engineering factors including apparent geothermal gradients, depths and pressures of the various formations to be penetrated and all other pertinent information about the area. All depths in this Order refer to true vertical depth (TVD) below ground level, unless otherwise specified.

A. Conductor Casing. This casing shall be set at a minimum depth of 15 metres (50 feet) and a maximum depth of 60 metres (200 feet) before drilling into shallow formations suspected or known to contain geothermal resources, non-condensible gases, or other mineral resources or upon encountering such formations.

B. Surface Casing. This casing shall be set at a depth equivalent to or in excess of ten percent of the proposed total depth of the well provided, however, that such setting depth shall be not less than 60 metres (200 feet) nor more than 400 metres (1,300 feet).

C. Intermediate Casing. This casing shall be set at any time when required by well conditions encountered in drilling below the surface casing such as anomalous pressure zones, uncased fresh water aquifers, cave-ins, washouts, lost circulation zones, rapidly increasing thermal gradients or other drilling hazards. If a liner is used as an intermediate string, the lap shall be tested by a fluid entry or pressure test to determine whether a seal between the liner top and the next large casing string has been achieved. The liner overlap shall be a

minimum of 30 metres (100 feet). The test shall be recorded on the driller's log and may be witnessed by the Supervisor. In the event of lap or casing failure during the test, the lap or casing must be repaired or recemented and successfully retested as required by the Supervisor.

D. Production Casing. This casing may be set at the top of or through the potential producing zone and shall be set before completing the well for production. Production casing shall be run to the surface or lapped into the next larger casing string. The liner overlap, if utilized, shall be at least 30 metres (100 feet) and shall be tested, witnessed and recorded as in the case of intermediate casing hereinabove. In the event of lap or casing failure during the test, the lap or casing must be repaired or recemented and successfully retested as required by the Supervisor. Production casing shall normally be of consistent nominal outside diameter from the surface or from the top of the lap to the casing shoe. The surface casing shall not be used as production casing, unless otherwise authorized by the Supervisor to meet special well conditions.

E. Cementing of Casing. The conductor and surface casing strings shall be cemented with a quantity of cement sufficient to fill the annular space back to the surface. The intermediate casing string shall likewise be cemented back to the surface or to the top of the lap if a liner is used as an intermediate string. Production casing shall be cemented with a high temperature resistant admix, unless waived by the Supervisor and shall be cemented in a manner necessary to exclude, isolate or segregate overlying formation fluids from the geothermal resources zone and to prevent the movement of fluids into possible fresh water zones.

Production casing shall be cemented back to the surface or, if lapped, to the top of the lap. A temperature or cement bond log may be required by the Supervisor after setting and cementing the production casing and after all primary cementing operations if an unsatisfactory cementing job is indicated. Proposed well cementing techniques differing from the requirements of this paragraph will be considered by the Supervisor on an individual well basis.

F. Pressure Testing. Prior to drilling out the casing shoe after cementing, all casing strings set to a depth of 152 metres (500 feet) or greater, except for conductor casing, shall be pressure tested to a minimum pressure of 69 bars (1,000 psi) or 0.045 bars/metre (0.2 psi/ft) whichever is greater. All casing strings set at a depth less than 152 metres (500 feet), except for conductor casing, shall be pressure tested to a minimum pressure of 35 bars (500 psi). Such test shall not exceed the rated working pressure of the casing or the blowout preventer stack assembly, whichever is lesser.

In the event of casing failure during the test, the casing must be repaired or recemented until a satisfactory test is obtained. A pressure decline of 10 percent or less in 30 minutes shall be considered satisfactory.

Casing test results shall be recorded on the driller's log and reported to the Supervisor within 30 days after the completion of such test. Advance notice of all casing and lap tests shall be given in sufficient time to enable the Supervisor to be present to witness such tests. The casing and lap test reports shall give a detailed description of the test; including mud and cement volumes, lapse of time between running

and cementing casing and testing, method of testing and test results.

G. Directional Surveys.

(1) General. Deviation surveys (inclination from vertical or single shot) shall be taken on all wells during the normal course of drilling at intervals not to exceed 152 metres (500 feet). The Supervisor may require a directional survey giving both inclination and azimuth or a dipmeter to be obtained on all wells. In calculating all surveys, a correction from true north to Lambert-Grid north shall be made after making the magnetic to true north correction. All surveys shall be filed with the Supervisor. Where directional surveys are required, composite surveys shall be filed with the Supervisor showing the interval from the bottom of the conductor casing to total depth.

(2) Vertical Wells. Wells are considered vertical if inclination does not exceed an average of five degrees from the vertical. The Supervisor may require a directional survey giving both inclination and azimuth at intervals not exceeding 30 metres (100 feet) between stations prior to, or upon, setting any casing string or liner (except conductor casing) and at total depth on any vertical well drilled in close proximity to lease boundaries or areas with an unstable land surface, highly faulted or steeply dipping beds, or in areas of suspected abnormal formation pressures.

(3) Directional Wells. Wells are considered directional if inclination exceed an average of five degrees from the vertical. Directional surveys giving both inclination and azimuth shall be obtained at intervals not to exceed 30 metres (100 feet) between stations prior to, or upon, setting any casing string or liner (except conductor

casing) and at total depth.

2. Blowout Prevention Equipment and Procedures. All necessary precautions shall be taken to keep wells under control at all times, utilize trained and competent personnel, and utilize properly maintained equipment and materials. Blowout preventers and related well control equipment shall be installed, tested immediately thereafter and maintained ready for use until drilling operations are completed. Certain components, such as packing elements and ram rubbers, shall be of high temperature resistant material as necessary. All kill lines, blowdown lines, manifolds and fittings shall be steel and shall have a temperature derated minimum working pressure rating equivalent to the maximum anticipated wellhead surface pressure. Subject to subparagraphs (A) and (B) hereinbelow blowout prevention equipment shall have manually operated gates and hydraulic actuating systems and accumulators of sufficient capacity to close all of the hydraulically-operated equipment and have a minimum pressure of 69 bars (1000 psi) remaining on the accumulator. Dual control stations shall be installed with a high pressure backup system. One control panel shall be located at the driller's station and one control panel shall be located on the ground at least 15 metres (50 feet) away from the wellhead or rotary table. Air or other gaseous fluid drilling systems shall have blowout prevention assemblies. Such assemblies may include, but are not limited to, a rotating head, a double ram blowout preventer or equivalent, a banjo-box or an approved substitute therefore and a blind ram blowout preventer or gate valve, respectively. Exceptions to the requirements of this paragraph will be considered by the Supervisor only for certain geologic and well conditions

such as stable surface areas with known low subsurface formation pressures and temperatures.

A proposed blowout prevention program and a blowout contingency plan including proposed containment, public health and safety and clean-up measures shall be submitted with the Application for Permit to Drill (Form 9-331C).

A. Conductor Casing. Before drilling below this string, at least one remotely controlled hydraulically-operated expansion-type preventer or an acceptable alternative, approved by the Supervisor, including a drilling spool with side outlets or equivalent, shall be installed. A kill line and blowdown line with appropriate fittings shall be connected to the drilling spool.

B. Surface, Intermediate and Production Casing. Before drilling below any of these strings, the blowout prevention equipment shall include a minimum of:

(1) one expansion-type preventer and accumulator or a rotating head;

(2) a manual and remotely controlled hydraulically-operated double ram blowout preventer or equivalent having a temperature derated minimum working pressure rating which exceeds the maximum anticipated surface pressure at the anticipated reservoir fluid temperature;

(3) a drilling spool with side outlets or equivalent;

(4) a fillup line;

(5) a kill line equipped with at least one valve; and

(6) a blowdown line equipped with at least two valves and securely anchored at all bends and at the end.

C. Testing and Maintenance. Ram-type blowout preventers and auxiliary equipment shall be tested to a minimum of 69 bars (1,000 psi) or to the working pressure of the casing or assembly, whichever is the lesser. Expansion-type blowout preventers shall be tested to 70 percent of the above pressure testing requirements.

The blowout prevention equipment shall be pressure tested:

(1) when installed;

(2) prior to drilling out plugs and/or casing shoes;

(3) not less than once each week, alternating the control stations; and

(4) following repairs that require disconnecting a pressure seal in the assembly.

During drilling operations blowout prevention equipment shall be actuated to test proper functioning as follows:

(1) once each trip for blind and pipe rams but not less than once each day for pipe rams; and

(2) at least once each week on the drill pipe for expansion-type preventers.

All flange bolts shall be inspected at least weekly and retightened as necessary during drilling operations. The auxiliary control systems shall be inspected daily to check the mechanical condition and effectiveness and to ensure personnel acquaintance with the method of operation. Blowout prevention and auxiliary control equipment shall be cleaned, inspected and repaired, if necessary, prior to installation to assure proper functioning. Blowout prevention controls shall be plainly labeled, and all crew members shall be instructed on

the function and operation of such equipment. A blowout prevention drill shall be conducted weekly for each drilling crew. All blowout prevention tests and crew drills shall be recorded on the driller's log.

D. Related Well Control Equipment. A full opening drill string safety valve in the open position shall be maintained on the rig floor at all times while drilling operations are being conducted. A kelly cock shall be installed between the kelly and the swivel.

3. Drilling Fluid. The properties, use and testing of drilling fluids and the conduct of related drilling procedures shall be such as are necessary to prevent the blowout of any well. Sufficient drilling fluid materials to ensure well control shall be maintained in the field area readily accessible for use at all times.

A. Drilling Fluid Control. Before pulling drill pipe, the drilling fluid shall be properly conditioned or displaced. The hole shall be kept reasonably full at all times, however, in no event shall the annular mud level be deeper than 30 metres (100 feet) from the rotary table when coming out of the hole with drill pipe. Mud cooling techniques shall be utilized when necessary to maintain mud characteristics for proper well control and hole conditioning.

B. Drilling Fluid Testing. Mud testing and treatment consistent with good operating practice shall be performed daily or more frequently as conditions warrant. Mud testing equipment shall be maintained on the drilling rig at all times.

The following drilling fluid system monitoring or recording devices shall be installed and operated continuously during drilling operations, with mud, occurring below the shoe of the conductor casing. No exceptions

to these requirements will be allowed without the specific prior permission of the Supervisor:

(1) high-low level mud pit indicator including a visual and audio-warning device;

(2) degassers, desilters and desanders;

(3) a mechnical, electrical or manual surface drilling fluid temperature monitoring device. The temperature of the drilling fluid going into and coming out of the hole shall be monitored, read and recorded on the driller's or mud log for a minimum of every 9 metres (30 feet) of hole drilled below the conductor casing; and

(4) a hydrogen sulfide indicator and alarm shall be installed in areas suspected or known to contain hydrogen sulfide gas which may reach levels considered to be dangerous to the health and safety of personnel in the area.

C. Monitoring. From the time drilling operations are initiated and until the well is completed or abandoned, a member of the drilling crew or the toolpusher shall monitor the rig floor at all times for surveillance purposes, unless the well is secured with blowout preventers or cement plugs.

4. Well Logging. All wells shall be logged with an induction electric log or equivalent from total depth to the shoe of the conductor casing. The Supervisor may grant an exception to this requirement when well conditions make it impractical or impossible to meet the above requirements.

A. Electric Logs. The lessee shall furnish to the Supervisor two legible exact copies of all logs run, within 30 days after completion

of drilling operations on each well. Two copies of field prints of such logs shall be made immediately available to the Supervisor upon his request. Two copies of chemical analyses of geothermal fluids or other similar services performed shall be submitted to the Supervisor within 30 days after such services are completed.

B. Lithologic Logs. Two legible exact copies of core analysis reports and lithologic (mud) logs shall be submitted to the Supervisor within 30 days after the completion of such reports or logs, when such services are used. However, daily logs shall be made available to the Supervisor immediately upon the completion of such daily logs upon his request.

5. Wellhead Equipment and Testing.

A. Completions. All wellhead connections shall be fluid pressure tested to the API or ASA working pressure rating. Cold water is recommended as the testing fluid. Welding of wellhead connections shall be performed by a certified welder using materials in conformance with ASTM specifications.

B. Wellhead Equipment. All completed wells shall be equipped with a minimum of one casinghead with side outlets, one master valve and one production valve, unless otherwise authroized by the Supervisor. All casingheads, christmas trees, fittings, and connections shall have a temperature derated working pressure equal to or greater than the surface shut-in pressure of the well at reservoir temperature. Packing, sealing mediums and lubricants shall consist of materials or substances that function effectively at, and are resistant to, high temperatures. Wellhead equipment, valves, flanges and fittings shall meet minimum ASA

standards or minimum API Standard 6A specifications. Casinghead connections shall be made such that fluid can be pumped between casing strings.

C. Testing. Any well showing sustained casinghead pressure or leaking of geothermal fluids between casing strings shall be tested to determine the origin of the failure, when such failure point is not otherwise determinable, and corrective measures shall be taken.

6. Well Spacing. No producing interval of any well shall be located within 30 metres (100 feet) of the outer boundaries of the leased lands, except where approved by the Supervisor. No surface location of a well shall be located within 15 metres (50 feet) of the boundary of any legal subdivision unless otherwise authorized by the Supervisor. The Supervisor may approve or prescribe such well spacing as he determines to be necessary for the proper development of the geothermal resources in accordance with the provisions of 30 CFR 270.15.

Reid T. Stone
Area Geothermal Supervisor

APPROVED:

Russell G. Wayland
Chief, Conservation Division

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

GEOTHERMAL RESOURCES OPERATIONAL ORDER NO. 3

Effective February 1, 1975

PLUGGING AND ABANDONMENT OF WELLS

This Order is established pursuant to the authority prescribed in 30 CFR 270.11 and in accordance with 30 CFR 270.14 and 270.45. The lessee shall comply with the following minimum plugging and abandonment procedures for all geothermal resources wells. Oral approvals shall be in accordance with 30 CFR 270.11. All variances from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 270.48. Each Sundry Notice (Form 9-331) shall include a notation of any proposed variances from the requirements of this Order. References in this Order to approvals, determinations or requirements are to those given or made by the Area Geothermal Supervisor (Supervisor) or his delegated representative.

The lessee shall promptly plug and abandon any well on the leased land that is not in use or demonstrated to be potentially useful. No well shall be abandoned until its lack of capacity for further profitable production of geothermal resources has been demonstrated to the satisfaction of the Supervisor. No well shall be plugged and abandoned until the manner and method of plugging have been approved or prescribed by the Supervisor.

Cement used to plug any geothermal resources well, except that cement or concrete used for surface plugging, shall be placed in the hole by pumping through drill pipe or tubing. Such cement shall consist of a high temperature resistant admix, unless this requirement is waived by the Supervisor in accordance with the particular circumstances existing in that well or area.

Prior to commencing abandonment operations, the Supervisor shall be notified of all such proposed operations.

Each Sundry Notice (Form 9-331) shall include all information required under 30 CFR 270.45 and 270.72. Any bond or rider thereto, covering a lease or an individual well thereon, shall remain in full force and effect until the lease or individual well is properly abandoned and the surface properly restored. Written approval of the abandonment must be obtained from the Supervisor before release of any bonds will be recommended.

1. Permanent Abandonment.

A. Uncased Hole. In uncased portions of wells, cement plugs shall be placed to protect all subsurface mineral resources, including fresh water aquifers. Such plugs shall extend a minimum of 30 metres (100 feet) below, if possible, and 30 metres (100 feet) above such aforementioned zones. Cement plugs shall be placed in a manner necessary to isolate formations and to protect the fluids in such formations from interzonal migration or contamination.

B. Open Hole. Where there is open hole (uncased and open into the casing string above), a cement plug shall be placed in the deepest casing string by either (1) or (2) below. In the event lost circulation

conditions exist or are anticipated, or if the well has been drilled with air or other gaseous substance, the plug shall be placed in accordance with (3) below.

(1) A cement plug shall be placed across the shoe extending a minimum of 30 metres (100 feet) above the 30 metres (100 feet) below; or

(2) A cement retainer with effective back pressure control set approximately 30 metres (100 feet) above the casing shoe with at least 61 metres (200 feet) of cement below the retainer and 30 metres (100 feet) of cement above.

(3) A permanent bridge plug set at the casing shoe and capped with a minimum of 61 metres (200 feet) of cement.

C. Perforations, Junk, Fish and Collapsed Pipe. A cement plug shall be placed across production perforations, extending 30 metres (100 feet) below (where possible) and 30 metres (100 feet) above the perforated interval. When a cement retainer is used to squeeze cement the perforated interval, the retainer shall be set a minimum of 30 metres (100 feet) above the perforations. Where the casing contains perforations at or below fish, junk or collapsed casing, thereby preventing cleanout operations, a cement retainer shall be set at least 30 metres (100 feet) above such point, and the interval below the retainer shall be squeeze cemented.

D. Casing Shoes, Stubs, Laps, and Liners. No casing shall be cut and recovered without first obtaining the written approval of the Supervisor. A cement plug shall be placed across all casing stubs, laps, liner tops and all casing shoes not protected by an inner casing string. Such plug shall extend a minimum of 15 metres

(50 feet) below and 15 metres (50 feet) above any such shoe, stub, lap or liner top.

E. Plugging of Annular Space. All open annuli extending to the surface shall be plugged with cement.

F. Surface Plug. The innermost casing string which reaches ground level shall be cemented or concreted to a minimum depth of 15 metres (50 feet) measured from 2 metres (6 feet) below ground level.

G. Testing of Plugs. The hardness and location of cement plugs placed across perforated intervals and at the top of uncased or open hole shall be verified by setting down with tubing or drill pipe a minimum of 6,803 kilograms (15,000 pounds) weight on the plug of the maximum weight of the available tubing or drill pipe string, if less than 6,803 kilograms (15,000 pounds).

H. Mud. The intervals of the hole not filled with cement shall be filled with good quality heavy mud.

I. Surface Restoration. All casting strings shall be cut off at least 2 metres (6 feet) below ground level and capped by welding a steel plate on the casing stub. Cellars, pads, structures and other facilities shall be removed. The surface area shall be restored as specified by the Supervisor in consultation with the appropriate surface management agency.

2. Temporary Abandonment. An uncompleted drilling well that is to be temporarily abandoned shall be mudded and cemented as required hereinabove for permanent abandonment except for the provisions of subparagraphs E, F, and I.

3. Suspended Wells. The drilling equipment shall not be removed on any geothermal resources well where drilling operations have been suspended, either temporarily or indefinitely, without prior approval of the Supervisor and after approved measures have been taken to close the well and to protect all subsurface resources, including fresh water aquifers.

Reid T. Stone
Area Geothermal Supervisor

APPROVED:

Russell G. Wayland
Chief, Conservation Division

Public Library, Reno, Nevada.
State Library, Carson City, Nevada.

A limited number of copies of the statement are also available to the public, interested agencies, and groups at the Bureau of Land Management addresses listed above for the District, State, and Washington Offices.

Dated: January 23, 1975.

STANLEY D. DOREMUS,
Deputy Assistant Secretary of the Interior.

[FR Doc.75-2504 Filed 1-27-75;8:45 am]

Geological Survey

GENERAL ENVIRONMENTAL PROTECTION

Proposed Geothermal Resources Operational Order No. 4

Notice is hereby given that pursuant to 30 CFR 270.11, and in accordance with 30 CFR 270.41 et al., the Chief, Conservation Division, Geological Survey, proposes to approve GRO Order No. 4 for geothermal operations conducted in the Central and Western Regions as set forth below.

The purpose of proposed GRO Order No. 4 is to provide requirements to geothermal operators for general environmental protection measures.

Interested persons may submit written comments, suggestions, and objections concerning the proposed Order to the Chief, Conservation Division, U.S. Geological Survey, Mail Stop 650, 12201 Sunrise Valley Drive, Reston, Virginia 22092, with a copy to the Area Geothermal Supervisor, 345 Middlefield Road, Menlo Park, California 94025, on or before March 1, 1975.

W. A. RADLINSKI,
Acting Director.

GEOTHERMAL RESOURCES OPERATIONAL ORDER No. 4

GENERAL ENVIRONMENTAL PROTECTION REQUIREMENTS

This Order is established pursuant to the authority prescribed in 30 CFR 270.11 and in accordance with 30 CFR 270.41, 270.42, 270.43 and 270.44. The lessee shall comply with the provisions of this Order. All variances from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 270.48. References in this Order to approvals, determinations or requirements are to those given or made by the Area Geothermal Supervisor (Supervisor) or his delegated representative.

Protection of the environment includes the lessee's responsibility to assure that exploration and development operations will be conducted with the maximum protection of the environment; that disturbed lands will be rehabilitated; that precautions will be taken to protect the public health and safety; and, that the lessee shall fully comply with the spirit and objectives of the National Environmental Policy Act of 1969, other Federal environmental legislation and supporting Executive Orders.

Prevention and mitigation of environmental impacts from geothermal-related activity shall be accomplished through enforcement of applicable Federal, State and local standards, and the application of existing technology. The occurrence of unacceptable environmental impacts which cannot be corrected shall be construed as grounds for suspension of operations as deemed necessary by the Supervisor.

Monitoring of all potential environmental impacts may be conducted by the use of aerial surveys, inspections, periodic sampling, continuous recordings or by such other means or methods as deemed necessary or appropriate by the Supervisor. Due to the natural environmental differences among geothermal areas, the extent and frequency of such monitoring activities will be determined by the Supervisor on an individual basis. The lessee shall be responsible for the monitoring of readily identifiable localized environmental impacts associated with specific activities that are under the control of the lessee. In the event the Supervisor determines that the degree and adequacy of existing environmental protection regulations in certain areas are insufficient, the Supervisor may establish additional and more stringent requirements by issuance of subsequent Orders or modifying existing Orders.

The lessee, in accordance with the requirements of 30 CFR 270.76, shall file in duplicate with the Supervisor, on or before March 1 of each year, an annual report of compliance with environmental protection requirements.

1. *Aesthetics.* The lessee shall reduce visual impact where feasible by the careful selection of sites for operations and facilities on the leased lands. The design and construction of facilities shall be conducted in a manner such that the facilities will blend into the natural environmental setting of the area by the appropriate use of landscaping, vegetation, compatible color schemes and minimum profiles. Native plants or compatible vegetation shall be used, where possible, for landscaping and revegetation.

2. *Land Use and Restoration.* The lessee's operating plans shall be designed so that operations will result in the least disturbance of soil, streams, and native vegetation and such plans shall provide for the restoration and revegetation of all disturbed lands in a manner approved by the Supervisor and the appropriate land management agency. Land restoration shall include preparation and seeding with prescribed wildlife food and plant cover or improved and acceptable substitutes thereof which equal or enhance the food values for indigenous wildlife species and domesticated animals.

The lessee shall maintain the leased lands in a safe and workmanlike manner at all times and remove or store all supplies and scrap in an orderly fashion.

The lessee's operations under a geothermal lease shall not unreasonably interfere with or endanger operations under any lease, license, claim, permit or other authorized use on the same lands.

3. *Public Access.* The public shall have free and unrestricted access to geothermal leased lands, excepting however, where restrictions are necessary to protect public health and safety or where such public access would unduly interfere with the lessee's operations or the security thereof. The lessee shall provide warning signs, fencing, flag men, barricades or other safety measures deemed necessary by the Supervisor, to protect the public, wildlife and livestock from hazardous geothermal or related activities.

4. *Recreation.* The lessee shall be restricted from drilling and other operations in close proximity to established recreation sites and access routes thereto. If the natural setting provides adequate shielding of visual and aesthetic impacts, then the Supervisor at his discretion, with the consent of the land management agency, may allow the lessee to conduct operations near such recreation areas and access routes, provided however, that no operations shall be conducted within

a buffer zone of 200 feet around established recreational areas. Recreational values shall be adequately protected by the lessee through planning and designing of site development to minimize the aesthetic degradation of the particular recreation area.

5. *Erosion Control.* The lessee's operations shall be conducted in a manner such that there is minimum disturbance to natural drainage. The lessee shall provide adequate erosion and drainage control to prevent silts from disturbed sites entering water courses for soil and natural conservation protection.

Mitigating measures to lessen environmental damage shall include reseeding of disturbed soils, chemical stabilization, and dust and erosion control on well sites, roads and construction areas.

6. *Biota.* The lessee shall employ such measures as are deemed necessary by the Supervisor to protect fish and wildlife and their habitat including, but not limited to, the installation of wildlife watering devices where roads, well sites, or other developments created by the lessee alter natural springs.

The Supervisor at his discretion may request and use the expertise of Federal and State agencies and others as appropriate for advice and assistance in protecting fish and wildlife resources and values. Fish and wildlife population surveillance may be conducted by an appropriate government agency to detect significant adverse trends for the Supervisor's guidance as a basis for requiring necessary corrective actions.

7. *Cultural Resources Preservation.* The lessee shall exercise due diligence in the conduct of his operations to protect and preserve significant archaeological, historical, cultural, paleontological and unique geologic sites. The lessee shall not disturb any known cemetery or burial ground of any group or culture.

Unknown sites uncovered by the lessee shall be immediately reported to the Supervisor and operations on the particular site shall cease until said site can be assessed for its archaeological value and preservation.

The necessary controls and stipulations for the protection and preservation of archaeological and historical sites determined by a qualified archaeologist to have a significant value shall be issued on an individual basis by the Supervisor as warranted.

The preservation, restoration, maintenance and nomination of all resources to the National Register of Historic Places shall be in accordance with the provisions of Executive Order 11593 (36 FR 8921) entitled "Protection and Enhancement of the Cultural Environment."

8. *Subsidence Detection.* In the event subsidence or seismic activity results from the production of geothermal resources, as determined by monitoring activities by the lessee or a governmental body, the lessee shall take such mitigating actions as required by the lease terms or by the Supervisor.

Monitoring of the land surface prior to and during geothermal resources production can be helpful in a determination of the general stability of the leased lands particularly in certain geothermal areas such as the Imperial Valley in California which is currently undergoing subsidence from natural causes wholly unrelated to the production of geothermal resources. Production data, pressures, reinjection rates and volumes shall be accurately recorded and filed monthly with the Supervisor as provided in 30 CFR 270.37.

Remedial action for the prevention of subsidence or seismicity—based upon the Supervisor's assessment of the significance of the problem—may entail reduction in production rates, suspension of production, or an escalation of reinjection of waste or other fluids.

A. *Surveys.* All required surveys shall be second order or better and shall be conducted under the direct supervision of a registered civil engineer or licensed land surveyor using equipment acceptable by the National Ocean Survey for second order surveys. All such work shall be coordinated with the county surveyor of the county in which the surveys and bench marks are to be established. Level lines and networks shall be tied to existing regional networks, where available, and resurveyed annually.

Adjusted survey data shall be filed with the Supervisor within 60 days after leveling is completed. The lessee of a commercially productive geothermal well or wells shall participate in any proposed or developed cooperative County-State subsidence detection program. All survey data filed with the Supervisor shall become part of the public domain.

B. *Bench Marks.* One or more wellsite bench marks shall be required at each completed well, prior to prolonged production, and said bench marks shall be located in a manner such that there is a minimal probability of destruction or damage to said bench marks. Wellsite bench marks shall be tied to existing regional networks. Additional bench marks between the wellsites and the regional network shall be at half-mile intervals or as otherwise specified by the Supervisor.

Acceptable bench marks include, but are not limited to, a brass rod driven to refusal or 9 metres (about 30 feet) and fitted with an acceptable brass plate, and a permanent structure with an installed acceptable brass plate.

C. *Reservoir Data.* Initial reservoir pressure and static equilibrium reservoir temperature shall be reported to the Supervisor in duplicate on Well Completion or Recompletion Report (Form 9-330C) for all completed wells within 30 days after the completion of measurements or tests conducted for the purpose of obtaining such data. Initial production test data including steam-water ratio, surface pressure and temperature, and quality and quantity of well effluent shall also be filed with the Supervisor on Form 9-330C within 30 days after a well is completed.

D. *Seismic Monitoring.* The installation of seismographs or other like instruments in producing geothermal areas for the purpose of monitoring potential seismic activity may be initiated from time to time by appropriate public agencies. The lessee and the appropriate public agency should take care not to unreasonably interfere with or endanger each other's respective operations. The Supervisor shall coordinate such monitoring programs between the appropriate public agency conducting the program and the lessee.

9. *Pollution and Waste Disposal.* The lessee shall comply with all applicable Federal and State standards with respect to the control of all forms of air, land, water and noise pollution, including the control of erosion and the disposal of liquid, solid and gaseous wastes. The Supervisor may, at his discretion, establish additional and more stringent standards and, if he does so, the lessee shall comply with those standards. Plans for disposal of well effluents must be approved by the Supervisor before action is taken under them. Immediate corrective action shall be taken in all cases where pollution has occurred.

The lessee shall remove or dispose of all waste including human waste, trash, refuse and extraction and processing waste generated in connection with the lessee's operations in a manner acceptable to the Supervisor.

The lessee shall provide safeguards to minimize potential accidental fires and shall instruct field personnel in fire prevention methods. The lessee shall maintain fire-fighting equipment in working order at strategic locations on the leased lands.

A. *Pollution Prevention.* In the conduct of all geothermal operations, the lessee shall not contaminate any natural waters, adversely affect the environment or materially damage the aesthetic values of the leased or adjacent property.

(1) *Liquid Disposal.* Liquid well effluent or the liquid residue thereof containing substances, including heat, which may be harmful or injurious in any manner shall be reinjected into the geothermal resources zone or such other formation as is approved by the Supervisor.

Drilling fluids shall be disposed of at approved disposal sites or in such other manner as approved by the Supervisor.

(2) *Solid Waste Disposal.* Drill cuttings, sand, precipitates and other solids shall be disposed of as directed by the Supervisor either on location or at other approved disposal sites. Mud and chemical containers and other solid waste materials shall be disposed of in specified places.

(3) *Gas Disposal.* Noncondensible gases such as carbon dioxide, ammonia and hydrogen sulfide may be vented or ejected into the atmosphere, provided however, that the volume and the measured concentration of such vented gas or gases shall not violate Federal, State or local air pollution standards.

(4) *Pits and Sumps.* Pits and sumps shall be lined with impervious material and purged of environmentally harmful chemicals and precipitates before back-filling. In no event shall the contents of a pit or sump be allowed to contaminate streams, lakes and ground waters or adversely affect the natural environment of the area or damage the aesthetic values of the property. When no longer used or useful, pits and sumps shall be back-filled and the premises restored to a near natural state or an improvement thereon as prescribed by the Supervisor.

(5) *Production Facilities Maintenance.* Production facilities shall be operated and maintained at all times in a manner necessary to prevent pollution. The lessee's field personnel shall be instructed in the proper maintenance and operations of production facilities for the prevention of pollution.

B. *Inspections and Reports.* Lessees shall comply with the following pollution inspection and reporting requirements.

(1) *Pollution Inspections.* Drilling and production facilities shall be inspected daily by the lessee. Appropriate preventative maintenance shall be performed as necessary to prevent failures and malfunctions which could lead to pollution. Suspended wells, completed nonproducing (idle) wells and areas or fields not under production shall be inspected at intervals as prescribed by the Supervisor. Necessary repairs or maintenance shall be made as required.

(2) *Pollution Reports.* All minor leakage or spills in violation of Federal, State or local pollution standards shall be reported orally within 24 hours to the appropriate Geothermal District Supervisor, and shall be followed within 10 days thereof by a written report stating the cause and corrective action taken.

All substantial spills or leakage of pollutants and those of any size or quantity which cannot be immediately controlled or any significant effect on the environment created by the lessee's operations shall be reported orally within 24 hours to the Supervisor. The lessee shall then submit a written report, within 30 days, stating the cause and the corrective action taken.

Emissions into the atmosphere of noncondensible or toxic gases such as hydrogen sulfide and ammonia shall be reported as hereinabove required for minor or substantial leakage.

C. *Injection.* The use of any subsurface formation, including the geothermal resources zone, for well effluent disposal, the residue thereof or for the injection of fluids for other purposes such as subsidence prevention, shall not be permitted until the lessee has submitted a plan of injection covering the proposed injection project and has subsequently received the Supervisor's written approval thereof.

(1) *Plan of Injection.* The plan of injection shall include the quantity, quality and source of the proposed injection fluid; the means and method by which the fluid is to be injected; a structure map contoured on the intended injection zone; and cross-sections showing producing well locations and the proposed injection well location(s). A copy of the lessee's plan of injection shall be submitted to adjacent lessees if required.

(2) *Injection Report.* The lessee shall file in duplicate with the Supervisor a Monthly Water Injection Report on a form prescribed by and available from the Supervisor. The subject report shall be filed on or before the last day of the month following the month for which the report is filed.

(3) *Inspection.* Injection wells and facilities shall be inspected at intervals as prescribed by the Supervisor to ascertain that all injected fluids are confined to the approved injection zone. A spinner survey, a radioactive tracer survey and a cement bond log may be required on each injection well within 30 days after injection begins. The lessee shall furnish to the Supervisor two legible exact copies of any and all such surveys and logs. In the event of a casing failure, inadequate annular cement or other mechanical failure, the lessee shall without unreasonable delay repair, suspend or abandon the well.

(4) *New Wells.* The drilling of new injection wells in accordance with an approved plan of injection shall be in conformance with the provisions of GRO Order No. 2. An Application for Permit to Drill, Form 9-331C, shall be filed in triplicate for each injection well.

(5) *Conversions.* The conversion of an existing well to an injection well in accordance with or modification of an approved plan of injection shall be in conformance with the requirements of GRO Order No. 2. The lessee shall demonstrate to the satisfaction of the Supervisor by appropriate testing and logging that the well is mechanically sound and suitable for injection purposes. A Sundry Notice, Form 9-331, shall be filed in triplicate for each conversion.

10. *Water Quality.* The primary responsibility for water quality and pollution control has been delegated to the States where such States have standards approved by the Environmental Protection Agency. Such States must meet basic Federal requirements prohibiting the deterioration of waters whose existing quality is higher than established water quality standards. The lessee shall comply with the State water quality control organization's requirements in such States as have federally approved standards. The Supervisor, at his discretion, may establish additional and more stringent standards and, if so, the lessee shall comply with such standards.

The lessee shall file, in duplicate, water analysis reports with the Supervisor. Such analyses shall include a determination of arsenates, borates, radioactive content and radioactivity of the produced fluids. In the

event that a health hazard exists, the Supervisor shall issue an Order requiring appropriate health and safety precautions and periodic monitoring. Such Order shall require the suspension of production if radioactivity is present and cannot be held to an acceptable level.

11. *Noise Abatement.* The lessee shall minimize noise during exploration, development and production activities. The method and degree of noise abatement shall be as approved by the Supervisor.

The lessee shall conduct noise level measurements during exploration, development and production operations to determine the potential objectionability to nearby residents as well as the potential health and safety danger due to noise emissions.

Noise level measurements and accompanying data shall be filed with the Supervisor. Such data shall provide the basis for operational and noise control decisions by the Supervisor and shall be based on an assessment of the noise with respect to established local, State or Federal criteria including adjustments for the area involved and the time of day of the noise occurrence.

The lessee shall comply with Federal occupational noise exposure levels applicable to geothermal activity under the Occupational Safety and Health Act of 1970 as set forth in 29 CFR 1910.95 incorporated herein by reference or with State standards for protection of personnel where such State standards are more restrictive than Federal standards.

A. *Noise Measurement Conditions.* Outdoor measurements shall be made at least 10 feet from structures, facilities or other sound reflecting sources and from 3 to 4 feet above ground level. Extreme weather conditions, electrical interference and unusual background noise levels shall be avoided or given due consideration when measuring sound levels.

B. *Noise Measurements.* The lessee shall monitor and measure noise levels using an octave band noise analyzer with an A-weighted frequency response or a standard sound level meter that conforms to the requirements set forth in USA Standard Specifications for General Purpose Sound Level Meters USASI S1.4–1961 or the latest approved revision thereof. Bandpass filters shall conform to the requirements of USASI S1.11–1966. The lessee shall measure noise level frequency distribution as required by the Supervisor. Sound levels shall be measured in conformance with the USA Standard-Method for the Physical Measurement of Sound USASI S1.2–1962.

C. *Noise Criteria.* In the absence of more restrictive criteria as may be established in this paragraph, the lessee shall not exceed a noise level of 65 dB(A) for all geothermal-related activity including but not limited to exploration, development or production operations as measured at the lease boundary line or one-half mile from the source, whichever is greater, using the A-weighted network of a standard Sound Level Meter. Provided, however, that the permissible noise level may be exceeded, with the Supervisor's approval, under emergency conditions or if written permission is obtained by the lessee from all parties affected by the noise which is in excess of 65 dB(A).

D. *Noise Assessment.* The lessee shall be responsible for taking such noise level measurements as are deemed necessary by and in the presence of the Supervisor. The background noise level shall serve as the criterion for the rating and assessment, by the Supervisor, of the objectionableness of noise emission from a particular source. The background or ambient noise is defined hereby as the minimum sound level at the relevant place and time in the absence of the source noise and shall include consideration for the type of land use, the season and the time of day.

E. *Attenuation.* To attenuate objectionable noise, the lessee shall utilize properly designed muffling devices as required by the Supervisor.

F. *Relationships.* Reference levels and relationships for noise measurements shall be as follows:

(1) Reference sound pressure for airborne sounds shall be 20 MN/m^2 (20 micronewtons per square metre).

(2) Reference power shall be 10^{-12} watts.

(3) Sound levels shall be measured using a standard Sound Level Meter with an "A" frequency response characteristic (weighting network).

(4) Sound level meter controls shall be set for as uniform a frequency response as possible when measuring sound pressure levels.

(5) Octave band noise levels shall be reported in equivalent A-weighted levels.

B. *Record of Sound Measurements.* A record of sound level measurements shall be filed in duplicate with the Supervisor and shall include the following data:

(1) Date and time.

(2) Name of observer.

(3) Description of primary noise source emitter under test.

(4) Kind of operation and operating conditions.

(5) Description of secondary noise sources including location, type and kind of operation.

(6) Type and serial numbers on all microphones, sound level meters and octave band analyzers used. Length and type of microphone cables.

(7) Position of observer.

(8) Direction of arrival of sound with respect to microphone orientation.

(9) Approximate temperature of microphone.

(10) Results of maintenance and calibration tests.

(11) Weighting network and meter speed used.

(12) Measured overall response and band levels at each microphone position and extent of meter fluctuation.

(13) Background overall response and band levels at each microphone position with primary noise source not operating.

(14) Cable and microphone corrections.

(15) Any other pertinent data such as personnel exposed directly and indirectly, time pattern of the exposure, attempts at noise control and personnel protection.

Effective: ____________.

REID T. STONE,
Area Geothermal Supervisor.

Approved:

RUSSELL G. WAYLAND,
Chief, Conservation Division.

[FR Doc.75-2435 Filed 1-27-75;8:45 am]

GRASS CREEK, WYOMING

Known Leasing Area (Coal)

Pursuant to authority contained in the Act of March 3, 1879 (43 U.S.C. 31), as supplemented by Reorganization Plan No. 3 of 1950 (43 U.S.C. 1451, note), and 203 Departmental Manual No. 1, and Secretary's Order No. 2948, Federal lands within the State of Wyoming have been classified as subject to the competitive coal leasing provisions of the Mineral Leasing Act of February 25, 1920, as

Form 3200–21
(May 1974)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

GEOTHERMAL RESOURCES LEASE

☐ Competitive ☐ Noncompetitive

Serial Number

USGS – KGRA Determination:

In consideration of the terms and conditions contained herein, and the grant made hereby, this lease is entered into by the UNITED STATES OF AMERICA (hereinafter called the "Lessor"), acting through the Bureau of Land Management (hereinafter called the "Bureau") of the Department of the Interior (hereinafter called the "Department"), and

(hereinafter called the "Lessee").

This lease is made pursuant to the Geothermal Steam Act of 1970 (84 Stat. 1566; 30 U.S.C. 1001–1025) (hereinafter called "the Act") to be effective on (hereinafter called the "effective date"). It is subject to all the provisions of the Act and to all the terms, conditions, and requirements of (a) all regulations promulgated by the Secretary of the Interior (hereinafter called "the Secretary") in existence upon the effective date, specifically including, but not limited to, 43 CFR Parts 3000 and 3200 and 30 CFR Parts 270 and 271, (b) all geothermal resources operational orders (hereinafter called "GRO orders") issued pursuant thereto, all of which are incorporated herein and by reference made a part hereof, and (c) any regulations hereafter issued by the Secretary (except those inconsistent with any specific provisions of this lease other than regulations incorporated herein by reference) all of which shall be, upon their effective date, incorporated herein and, by reference, made a part hereof.

Sec. 1. GRANT – The Lessor hereby grants and leases to the Lessee the exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal steam and associated geothermal resources, (hereinafter called "geothermal resources"), in or under the following described lands situated within the County of ,

State of :

National Resource Lands	Acquired Lands
T. ; R. ; Meridian	T. ; R. ; Meridian
Total Area	Total Area

Containing acres (hereinafter called the "leased area" or "leased lands"), together with:

(a) The nonexclusive right to conduct within the leased area geological and geophysical exploration in accordance with applicable regulations; and

(b) The right to construct or erect and to use, operate, and maintain within the leased area, together with ingress and egress thereupon all wells, pumps, pipes, pipelines, buildings, plants, sumps, brine pits, reservoirs, tanks, waterworks, pumping stations, roads, electric power generating plants, transmission lines, industrial facilities, electric, telegraph or telephone lines, and such other works and structures and to use so much of the surface of the land as may be necessary or reasonably convenient for the production, utilization, and processing of geothermal resources or to the full enjoyment of the rights granted by this lease, subject to compliance with applicable laws and regulations; *Provided that,* although the use of the leased area for an electric power generating plant or transmission facilities or a commercial or industrial facility is authorized hereunder, the location of such facilities and the terms of occupancy therefor shall be under separate instruments issued under any applicable laws and regulations; and

(c) The nonexclusive right to drill potable water wells in accordance with state water laws within the leased area and to use the water produced therefrom for operations on the leased lands free of cost, provided that such drilling and development are conducted in accordance with procedures approved by the Supervisor of the Geological Survey (hereinafter called "Supervisor"); and

(d) The right to convert this lease to a mineral lease under the Mineral Leasing Act of February 25, 1920, as amended, and supplemented (30 U.S.C. 181–287) or under the Mineral Leasing Act for Acquired Lands (30 U.S.C. 351–359), whichever is appropriate, if the leasehold is primarily valuable for the production of one or more valuable by-products which are leasable under those statutes, and the lease is incapable of commercial production or utilization of geothermal steam: *Provided that,* an application is made therefor prior to the expiration of the lease extension by reason of by-product production as hereinafter provided, and subject to all the terms and conditions of said appropriate Acts. The Lessee is also granted the right to locate mineral deposits under the mining laws (30 U.S.C. 21–54), which would constitute by-products if commercial production or utilization of geothermal steam continued, but such a location to be valid must be completed within ninety (90) days after the termination of this lease. Any conversion of this lease to a mineral lease or a mining claim is contingent on the availability of such lands for this purpose at the time of the conversion. If the lands are withdrawn or acquired in aid of a function of any Federal Department or agency, the mineral lease or mining claim shall be subject to such additional terms and conditions as may be prescribed by such Department or agency for the purpose of making operations thereon consistent with the purposes for which these lands are administered; and

(e) The right, without the payment of royalties hereunder, to reinject into the leased lands geothermal resources and condensates to the extent that such resources and condensates are not utilized, but their reinjection is necessary for operations under this lease in the recovering or processing of geothermal resources. If the Lessee, pursuant to any approved plan, disposes of the unusable brine and produced waste products into underlying formations, he may do so without the payment of royalties.

Sec. 2. TERM

(a) This lease shall be for a primary term of ten (10) years from the effective date and so long thereafter as geothermal steam is produced or utilized in commercial quantities but shall in no event continue for more than forty (40) years after the end of the primary term. However, if at the end of that forty-year period geothermal steam is being produced or utilized in commercial quantities, and the leased lands are not needed for other purposes, the Lessee shall have a preferential right to a renewal of this lease for a second forty-year term in accordance with such terms and conditions as the Lessor deems appropriate.

(b) If actual drilling operations are commenced on the leased lands or under an approved plan or agreement on behalf of the leased lands prior to the end of the primary term, and are being diligently prosecuted at the end of the primary term, this lease shall be extended for five (5) years and so long thereafter, but not more than thirty-five (35) years, as geothermal steam is produced or utilized in commercial quantities. If at the end of such extended term geothermal steam is being produced or utilized in commercial quantities, the Lessee shall have a preferential right to a renewal for a second term as in (a) above.

(c) If the Lessor determines at any time after the primary term that this lease is incapable of commercial production and utilization of geothermal steam, but one or more valuable by-products are or can be produced in commercial quantities, this lease shall be extended for so long as such by-products are produced in commercial quantities but not for more than five (5) years from the date of such determination.

Sec. 3. RENTALS AND ROYALTIES

(a) *Annual Rental* — For each lease year prior to the commencement of production of geothermal resources in commercial quantities on the leased lands, the Lessee shall pay the Lessor on or before the anniversary date of the lease a rental of $ for each acre or fraction thereof.

(b) *Escalating Rental* — Beginning with the sixth lease year and for each year thereafter until the lease year beginning on or after the commencement of production of geothermal resources in commercial quantities, the Lessee shall pay on or before the anniversary date of the lease an escalated rental in an amount per acre or fraction thereof equal to the rental per acre for the preceding year and an additional sum of one (1) dollar per acre or fraction thereof. If the lease is extended beyond ten (10) years for reasons other than the commencement of production of geothermal resources in commercial quantities, the rental for the eleventh year and for each lease year thereafter until the lease year beginning on or after the commencement of such production will be the amount of rental for the tenth lease year. If any expenditures are made in any lease year for diligent exploration on the leased lands in excess of the minimum required expenditures for that year, the excess may be credited against any rentals in excess of $ per acre or fraction thereof due the Lessor for that or any future year.

(c) *Royalty* — On or before the last day of the calendar month after the month of commencement of production in commercial quantities of geothermal resources and thereafter on a monthly basis, the Lessee shall pay to the Lessor:

(1) A royalty of percent on the amount or value of steam, or any other form of heat or other associated energy produced, processed, removed, sold, or utilized from this lease or reasonably susceptible to sale or utilization by the Lessee.

(2) A royalty of percent of the value of any by-product derived from production under this lease, produced, processed, removed, sold, or utilized from this lease or reasonably susceptible of sale or utilization by the Lessee, except that as to any by-product which is a mineral named in Sec. 1 of the Mineral Leasing Act of February 25, 1920, as amended, (30 U.S.C. 181), the rate of royalty for such mineral shall be the same as that provided in that statute and the maximum rate of royalty for such mineral shall not exceed the maximum royalty applicable under that statute.

(3) A royalty of percent of the value of commercially demineralized water which has been produced from the leased lands, and has been sold or utilized by the Lessee or is reasonably susceptible of sale or utilization by the Lessee. In no event shall the Lessee pay to the Lessor, for the lease year beginning on or after the commencement of production in commercial quantities on the leased lands or any subsequent lease year, a royalty of less than two (2) dollars per acre or fraction thereof. If royalty paid on production during the lease year has not satisfied this requirement, the Lessee shall pay the difference on or before the expiration date of the lease year for which it is paid.

(d) *Waiver and Suspension of Rental and Royalties* — Rentals or royalties may be waived, suspended, or reduced pursuant to the applicable regulations on the entire leasehold or any portion thereof in the interest of conservation or for the purpose of encouraging the greatest ultimate recovery of geothermal resources if the Lessor determines that it is necessary to do so to promote such development, or because the lease cannot be successfully operated under the terms fixed herein.

(e) *Undivided Fractional Interests* — Where the interest of the Lessor in the geothermal resources underlying any tract or tracts described in Sec. 1 is an undivided fractional interest, the rentals and royalties payable on account of each such tract shall be in the same proportion to the rentals and royalties provided in this lease as the individual fractional interest of the Lessor in the geothermal resources underlying such tract is to the full fee interest.

(f) *Readjustments* — Rentals and royalties hereunder may be readjusted in accordance with the Act and regulations to rates not in excess of the rates provided therein, and at not less than twenty (20) year intervals beginning thirty-five (35) years after the date geothermal steam is produced from the lease as determined by the Supervisor.

Sec. 4. PAYMENTS — It is expressly understood that the Secretary may establish the values and minimum values of geothermal resources to compute royalties in accordance with the applicable regulations. Unless otherwise directed by the Secretary, all payments to the Lessor will be made as required by the regulations. If there is no well on the leased lands capable of producing geothermal resources in commercial quantities, the failure to pay rental on or before the anniversary date shall cause the lease to terminate by operation of law except as provided by Sec. 3244.2 of the regulations. If the time for payment falls on a day on which the proper office to receive payment is closed, payment shall be deemed to be made on time if made on the next official working day.

Sec. 5. BONDS — The Lessee shall file with the Authorized Officer of the Bureau (hereinafter called the "Authorized Officer") shall maintain at all times the bonds required under the regulations to be furnished as a condition to the issuance of this lease or prior to entry on the leased lands in the amounts established by the Lessor and to furnish such additional bonds or security as may be required by the Lessor upon entry on the lands or after operations or production have begun.

Sec. 6. WELLS

(a) The Lessee shall drill and produce all wells necessary to protect the leased land from drainage by operations on lands not the property of the Lessor, or other lands of the Lessor leased at a lower royalty rate, or on lands as to which royalties and rentals are paid into different funds from those into which royalties under this lease are paid. However, in lieu of any part of such drilling and production, with the consent of the Supervisor, the Lessee may compensate the Lessor in full each month for the estimated loss of royalty through drainage in the amount determined by said Supervisor.

(b) At the Lessee's election, and with the approval of the Supervisor, the Lessee shall drill and produce other wells in conformity with any system of well spacing or production allotments affecting the field or area in which the leased lands are situated, which is authorized by applicable law.

(c) After due notice in writing, the Lessee shall diligently drill and produce such wells as the Supervisor shall require so that the leased lands may be properly and timely developed and for the production of geothermal steam and its by-products, including commercially demineralized water for beneficial uses in accordance with applicable state laws. However, the Supervisor may waive or modify the requirements of this subparagraph (c) in the interest of conservation of natural resources or for economic feasibility or other reasons satisfactory to him. If the products or by-products of geothermal production from wells drilled on this lease are susceptible of producing commercially demineralized water for beneficial uses, and a program therefor is not initiated with due diligence, the Lessor may at its option elect to take such products or by-products and the Lessee shall deliver all or any portion thereof to the Lessor at any point in the Lessee's geothermal gathering or disposal system without cost to the Lessee, if the Lessee's activities, under the lease, would not be impaired and such delivery would otherwise be consistent with field and operational requirements. The retention of this option by the Lessor shall in no way relieve the Lessee from the duty of producing commercially demineralized water where required to do so by the Lessor, except when the option is being exercised and then only with respect to wells where it is being exercised, or limit the Lessor's right to take any action under Sec. 25 to enforce that requirement.

Sec. 7. INSPECTION — The Lessee shall keep open at all reasonable times for the inspection of any duly authorized representative of the Lessor the leased lands and all wells, improvements, machinery, and fixtures thereon and all production reports, maps, records, books, and accounts relative to operations under the lease, and well logs, surveys, or investigations of the leased lands.

Sec. 8. CONDUCT OF OPERATIONS — The Lessee shall conduct all operations under this lease in a workmanlike manner and in accordance with all applicable statutes, regulations, and GRO orders, and all other appropriate directives of the Lessor to prevent bodily injury, danger to life or health, or property damage, and to avoid the waste of resources, and shall comply with all requirements which are set forth in 43 CFR Group 3200, including, but not limited to, Subpart 3204, or which may be prescribed by the Lessor pursuant to the regulations, and with the special stipulations which are attached to the lease, all of which are specifically incorporated into this lease. A breach of any term of this lease, including the stipulations attached hereto, will be subject to all the provisions of this lease with respect to remedies in case of default. Where any stipulation is inconsistent with a regular provision of this lease, the stipulation shall govern.

Sec. 9. INDEMNIFICATION

(a) The Lessee shall be liable to the Lessor for any damage suffered by the Lessor in any way arising from or connected with the Lessee's activities and operations conducted pursuant to this lease, except where damage is caused by employees of the Lessor acting within the scope of their authority.

(b) The Lessee shall indemnify and hold harmless the Lessor from all claims arising from or connected with the Lessee's activities and operations under this lease.

(c) In any case where liability without fault is imposed on the Lessee pursuant to this section, and the damages involved were caused by the action of a third party, the rules of subrogation shall apply in accordance with the law of the jurisdiction where the damage occurred.

Sec. 10. CONTRACTS FOR SALE OR DISPOSAL OF PRODUCTS — The Lessee shall file with the Supervisor not later than thirty (30) days after the effective date thereof any contract, or evidence of other arrangement for the sale or disposal of geothermal resources.

Sec. 11. ASSIGNMENT OF LEASE OR INTEREST THEREIN — Within ninety (90) days from the date of execution thereof, the Lessee shall file for approval by the Authorized Officer any instruments of transfer made of this lease or of any interest therein, including assignments of record title and working or other interests.

Sec. 12. REPORTS AND OTHER INFORMATION — At such times and in such form as the Lessor may prescribe, the Lessee shall comply with all reporting requirements of the geothermal resources leasing, operating, and unit regulations and shall submit quarterly reports containing the data which it has collected through the monitoring of air, land, and water quality and all other data pertaining to the effect on the environment by operations under the lease. The Lessee shall also comply with such other reporting requirements as may be imposed by the Authorized Officer or the Supervisor. The Lessor may release to the general public any reports, maps, or other information submitted by the Lessee except geologic and geophysical interpretations, maps, or data subject to 30 CFR 270.79 or unless the Lessee shall designate that information as proprietary and the Supervisor or the Authorized Officer shall approve that designation.

Sec. 13. DILIGENT EXPLORATION — In the manner required by the regulations, the Lessee shall diligently explore the leased lands for geothermal resources until there is production in commercial quantities applicable to this lease. After the fifth year of the primary term the Lessee shall make at least the minimum expenditures required to qualify the operations on the leased lands as diligent exploration under the regulations.

Sec. 14. PROTECTION OF THE ENVIRONMENT (LAND, AIR AND WATER) AND IMPROVEMENTS – The Lessee shall take all mitigating actions required by the Lessor to prevent: (a) soil erosion or damage to crops or other vegetative cover on Federal or non-Federal lands in the vicinity; (b) the pollution of land, air, or water; (c) land subsidence, seismic activity, or noise emissions; (d) damage to aesthetic and recreational values; (e) damage to fish or wildlife or their habitats; (f) damage to or removal of improvements owned by the United States or other parties; or (g) damage to or destruction or loss of fossils, historic or prehistoric ruins, or artifacts. Prior to the termination of bond liability or at any other time when required and to the extent deemed necessary by the Lessor, the Lessee shall reclaim all surface disturbances as required, remove or cover all debris or solid waste, and, so far as possible, repair the offsite and onsite damage caused by his activity or activities incidental thereto, and return access roads or trails and the leased lands to an acceptable condition including the removal of structures, if required. The Supervisor or the Authorized Officer shall prescribe the steps to be taken by Lessee to protect the surface and the environment and for the restoration of the leased lands and other lands affected by operations on the leased lands and improvements thereon, whether or not the improvements are owned by the United States. Timber or mineral materials may be obtained only on terms and conditions imposed by the Authorized Officer.

Sec. 15. WASTE – The Lessee shall use all reasonable precautions to prevent waste of natural resources and energy, including geothermal resources, or of any minerals, and to prevent the communication of water or brine zones with any oil, gas, fresh water, or other gas or water bearing formations or zones which would threaten destruction or damage to such deposits. The Lessee shall monitor noise, air, and water quality conditions in accordance with any orders of the Supervisor.

Sec. 16. MEASUREMENTS – The Lessee shall gauge or otherwise measure all production, sales, or utilization of geothermal resources and shall record the same accurately in records as required by the Supervisor. Reports on production, sales, or utilization of geothermal resources shall be submitted in accordance with the terms of this lease and the regulations.

Sec. 17. RESERVATIONS TO LESSOR – All rights in the leased area not granted to the Lessee by this lease are hereby reserved to the Lessor. Without limiting the generality of the foregoing such reserved rights include:

(a) *Disposal* – The right to sell or otherwise dispose of the surface of the leased lands or any resource in the leased lands under existing laws, or laws hereafter enacted, subject to the rights of the Lessee under this lease;

(b) *Rights-of-way* – The right to authorize geological and geophysical explorations on the leased lands which do not interfere with or endanger actual operations under this lease, and the right to grant such easements or rights-of-way for joint or several use upon, through or in the leased area for steam lines and other public or private purposes which do not interfere with or endanger actual operations or facilities constructed under this lease;

(c) *Mineral Rights* – The ownership of and the right to extract oil, hydrocarbon gas, and helium from all geothermal steam and associated geothermal resources produced from the leased lands;

(d) *Casing* – The right to acquire the well and casing at the fair market value of the casing where the Lessee finds only potable water, and such water is not required in lease operations; and

(e) *Measurements* – The right to measure geothermal resources and to sample any production thereof.

Sec. 18. ANTIQUITIES AND OBJECTS OF HISTORIC VALUE – The Lessee shall immediately bring to the attention of the Authorized Officer any antiquities or other objects of historic or scientific interest, including but not limited to historic or prehistoric ruins, fossils, or artifacts discovered as a result of operations under this lease, and shall leave such discoveries intact. Failure to comply with any of the terms and conditions imposed by the Authorized Officer with regard to the preservation of antiquities may constitute a violation of the Antiquities Act (16 U.S.C. 431-433). Prior to operations, the Lessee shall furnish to the Authorized Officer a certified statement that either no archaeological values exist or that they may exist on the leased lands to the best of the of the Lessee's knowledge and belief and that they might be impaired by geothermal operations. If the Lessee furnishes a statement that archaeological values may exist where the land is to be disturbed or occupied, the Lessee will engage a qualified archaeologist, acceptable to the Authorized Officer, to survey and salvage, in advance of any operations, such archaeological values on the lands involved. The responsibility for the cost for the certificate, survey, and salvage will be borne by the Lessee, and such salvaged property shall remain the property of the Lessor or the surface owner.

Sec. 19. DIRECTIONAL DRILLING – A directional well drilled under the leased area from a surface location on nearby land not covered by the lease shall be deemed to have the same effect for all purposes of this lease as a well drilled from a surface location on the leased area. In such circumstances, drilling shall be considered to have been commenced on the nearby land for the purposes of this lease, and production of geothermal resources from the leased area through any directional well located on nearby land, or drilling or reworking of any such directional well shall be considered production or drilling or reworking operations (as the case may be) on the leased area for all purposes of this lease. Nothing contained in this section shall be construed as granting to the Lessee any right in any land outside the leased area.

Sec. 20. OVERRIDING ROYALTIES – The Lessee shall not create overriding royalties of less than one-quarter (1/4) of one percent of the value of output nor in excess of 50 percent of the rate of royalty due to the Lessor specified in Sec. 3 of this lease except as otherwise authorized by the regulations. The Lessee expressly agrees that the creation of any overriding royalty which does not provide for a prorated reduction of all overriding royalties so that the aggregate rate of royalties does not exceed the maximum rate permissible under this section, or the failure to suspend an overriding royalty during any period when the royalties due to the Lessor have been suspended pursuant to the terms of this lease, shall constitute a violation of the lease terms.

Sec. 21. READJUSTMENT OF TERMS AND CONDITIONS – The terms and conditions of this lease other than those related to rentals and royalties may be readjusted in accordance with the Act at not less than ten-year intervals beginning ten (10) years after the date geothermal steam is produced from the leased premises as determined by the Supervisor.

Sec. 22. COOPERATIVE OR UNIT PLAN – The Lessee agrees that it will on its own, or at the request of the Lessor where it is determined to be necessary for the conservation of the resource or to prevent the waste of the resource, subscribe to and operate under any reasonable cooperative or unit plan for the development and operation of the area, field, or pool, or part thereof embracing the lands subject to this lease as the Secretary may determine to be practicable and necessary or advisable in the interest of conservation. In the event the leased lands are included within a unit, the terms of this lease shall be deemed to be modified to conform to such unit agreement. Where any provision of a cooperative or unit plan of development which has been approved by the Secretary, and which by its terms affects the leased area or any part thereof, is inconsistent with a provision of this lease, the provisions of such cooperative or unit plan shall govern.

Sec. 23. RELINQUISHMENT OF LEASE – The Lessee may relinquish this entire lease or any officially designated subdivision of the leased area in accordance with the regulations by filing in the proper BLM office a written relinquishment, in triplicate, which shall be effective as of the date of filing. No relinquishment of this lease or any portion of the leased area shall relieve the Lessee or its surety from any liability for breach of any obligation of this lease, including the obligation to make payment of all accrued rentals and royalties and to place all wells in the leased lands to be relinquished in condition for suspension or abandonment, and to protect or restore substantially the surface or subsurface resources in a manner satisfactory to the Lessor.

Sec. 24. REMOVAL OF PROPERTY ON TERMINATION OR EXPIRATION OF LEASE

(a) Upon the termination or expiration of this lease in whole or in part, or the relinquishment of the lease in whole or in part, as herein provided, the Lessee shall within a period of ninety (90) days (or such longer period as the Supervisor may authorize because of adverse climatic conditions) thereafter remove from the leased lands, no longer subject to the lease all structures, machinery, equipment, tools, and materials in accordance with applicable regulations and orders of the Supervisor. However, the Lessee shall, for a period of not more than six (6) months, continue to maintain any such property needed in the relinquished area, as determined by the Supervisor, for producing wells or for drilling or producing geothermal resources on other leases.

(b) Any structures, machinery, equipment, tools, appliances, and materials, subject to removal by the Lessee, as provided above, which are allowed to remain on the leased lands shall become the property of the Lessor on expiration of the 90-day period or any extension of that period which may be granted by the Supervisor. If the Supervisor directs the Lessee to remove such property, the Lessee shall do so at its own expense, or if it fails to do so within a reasonable period, the Lessor may do so at the Lessee's expense.

Sec. 25. REMEDIES IN CASE OF DEFAULT

(a) Whenever the Lessee fails to comply with any of the provisions of the Act, or the terms and stipulations of this lease, or of the regulations issued under the Act, or of any order issued pursuant to those regulations, and that default shall continue for a period of thirty (30) days after service of notice by the Lessor, the Lessor may (1) suspend operations until the requested action is taken to correct the noncompliance, or (2) cancel the lease in accordance with Sec. 12 of the Act (30 U.S.C. 1011). However, the 30-day notice provision applicable to this lease under Sec. 12 of the Act shall also apply as a prerequisite to the institution of any legal proceedings by the Lessor to cancel this lease while it is in a producing status. Nothing in this subsection shall be construed to apply to, or require any notice with respect to any legal action instituted by the Lessor other than an action to cancel the lease pursuant to Sec. 12 of the Act.

(b) Whenever the Lessee fails to comply with any of the provisions of the Act, or of this lease, or the regulations, or of any GRO Orders, or other orders, and immediate action is required, the Lessor without waiting for action by the Lessee may enter on the leased lands and take such measures as it may deem necessary to correct the failure, including a suspension of operations or production, all at the expense of the Lessee.

(c) A waiver of any particular violation of the provisions of the Act, or of this lease, or of any regulations promulgated by the Secretary under the Act, shall not prevent the cancellation of this lease or the exercise of any other remedy or remedies under paragraphs (a) and (b) of this section by reason of any other such violation, or for the same violation occuring at any other time.

(d) Nothing herein shall limit or affect the Lessee's right to a hearing and appeal as provided in Sec. 12 of the

Act and in the regulations promulgated thereunder.

(e) Upon cancellation, the Lessee shall remove all property in accordance with Sec. 24 hereof, and shall restore the leased lands in a manner acceptable to the Lessor or as may be otherwise required by the Lessor.

Sec. 26. HEIRS AND SUCCESSORS IN INTEREST – Each obligation hereunder shall extend to and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns, of the respective parties hereto.

Sec. 27. UNLAWFUL INTEREST – No Member of, or Delegate to Congress, or Resident Commissioner, after his election or appointment, either before or after he has qualified, and during his continuance in office, and no officer, agent, or employee of the Department shall be admitted to any share or part in this lease or derive any benefit that may arise therefrom; and the provisions of Sec. 3741 of the Revised Statutes (41 U.S.C. Sec. 22), as amended, and Sections 431, 432, and 433 of Title 18 of the United States Code, relating to contracts made or entered into, or accepted by or on behalf of the United States, form a part of this lease so far as the same may be applicable.

Sec. 28. MONOPOLY AND FAIR PRICES – The Lessor reserves full power and authority to protect the public interest by promulgating and enforcing all orders necessary to insure the sale of the production from the leased lands at reasonable prices, to prevent monopoly, and to safeguard the public interest.

Sec. 29. EQUAL OPPORTUNITY CLAUSE – The Lessee agrees that, during the performance of this contract:

(1) The Lessee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Lessor setting forth the provisions of this Equal Opportunity clause.

(2) The Lessee will, in all solicitations or advertisements for employees placed by or on behalf of the Lessee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(3) The Lessee will send to each labor union or representative of workers with which Lessee has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Lessor, advising the labor union or workers' representative of the Lessee's commitments under this Equal Opportunity clause, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The Lessee will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, as amended, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the Secretary of the Interior and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the Lessee's noncompliance with the Equal Opportunity clause of this lease or with any of said rules, regulations, or orders, this lease may be canceled, terminated or suspended in whole or in part and the Lessee may be declared ineligible for further Federal Government contracts or leases in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, as amended, and such other sanctions as may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, as amended, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The Lessee will include the provisions of Paragraphs (1) through (7) of this Section (29) in every contract, subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, as amended, so that such provisions will be binding upon each contractor, subcontractor, or subcontract, or purchase order as the Secretary may direct as a means of enforcing such provisions including sanctions for noncompliance; *provided, however,* that in the event the Lessee becomes involved in, or is threatened with, litigation with a contractor, subcontractor, or vendor as a result of such direction by the Secretary, the Lessee may request the Lessor to enter into such litigation to protect the interests of the Lessor.

Sec. 30. CERTIFICATION OF NONSEGREGATED FACILITIES – By entering into this lease, the Lessee certifies that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The Lessee agrees that a breach of this certification is a violation of the Equal Opportunity clause of this lease. As used in this certification, the term "segregated facilities" means, but is not limited to, any waiting rooms, work areas, rest rooms and wash rooms, or restaurants or other eating areas, time clocks, or locker rooms, and other storage or dressing rooms, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are in fact segregated on the basis of race, color, religion, or national origin because of habit, local custom, or otherwise. Lessee further agrees that (except where it has obtained identical certifications from proposed contractors and subcontractors for specific time periods) it will obtain identical certifications from proposed contractors and subcontractors prior to the award of contracts or subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause; that it will retain such certifications in its files; and that it will forward the following certification to such proposed contractors and subcontractors (except where the proposed contractor or subcontractor has submitted identical certifications for specific time periods); it will notify prospective contractors and subcontractors of requirement for certification of nonsegregated facilities. A Certification of Nonsegregated Facilities, as required by the May 9, 1967 Order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a contract or subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each contract and subcontract or for all contracts and subcontracts during a period (i.e., quarterly, semiannually, or annually).

Sec. 31. SPECIAL STIPULATIONS – *(stipulations, if any, are attached hereto and made a part hereof)*

In witness whereof the parties have executed this lease.
Lessee:

THE UNITED STATES OF AMERICA, Lessor:

(Signature of Lessee)

By ______________________
(Authorized Officer)

(Signature of Lessee)

(Title)

SEAL

(Date)

(Date)

APPENDIX F

IN REPLY REFER TO:

RB

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

POST OFFICE BOX 1306
ALBUQUERQUE, NEW MEXICO 87103

BLM
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March 12, 1975

Memorandum

To: District Manager, Bureau of Land Management,
Las Cruces, New Mexico 88001

From: Acting Regional Supervisor, Div. of River Basin Studies

Subject: Geothermal Leasing - Preliminary comments on Kilbourne Hole Leasing Area

This responds to your March 5, 1975, request for review and comment on the preliminary draft of the environmental analysis and technical southwest of Las Cruces, New Mexico. However, this memorandum is intended to provide preliminary assistance for your consideration and does not constitute the official views of the Fish and Wildlife Service on the report.

We have reviewed the report and note that it adequately reflects our views and recommendations regarding the effects that the proposed leasing exploration and development of the Kilbourne Hole area would have on fish and wildlife resources involved.

Thank you for the opportunity to review and comment on the preliminary draft report.

Donald C Dob

CONSERVE
AMERICA'S
ENERGY

Save Energy and You Serve America!

March 3, 1849

United States Department of the Interior
NATIONAL PARK SERVICE
White Sands National Monument
P. O. Box 458
Alamogordo, New Mexico 88310

IN REPLY REFER TO:
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March 24, 1975

District Manager
Bureau of Land Management
P. O. Box 1420
Las Cruces, New Mexico 88001

Dear Sir:

A copy of your management recommendations for the Las Uves Planning Unit has been circulated in our office. The attached comments made by some individuals are personal opinions.

We appreciate the opportunity to review the alternatives you have considered for each management category. We are well acquainted with the extra work and effort required to conduct open, public meetings on management plans. You have our whole-hearted support in what you are doing.

Sincerely,

James M. Thomson

James M. Thomson
Superintendent

Enclosures

CONSERVE
AMERICA'S
ENERGY

Save Energy and You Serve America!

March 3, 1849

United States Department of the Interior
NATIONAL PARK SERVICE
White Sands National Monument
P. O. Box 458
Alamogordo, New Mexico 88310

IN REPLY REFER TO:

March 24, 1975

District Manager
Bureau of Land Management
P. O. Box 1420
Las Cruces, New Mexico 88001

Dear Sir:

I have read the proposed management alternatives for the Las Uves Planning Unit and was present for the briefing on March 3. I wish to make the following personal comments:

Lands - I oppose land exchanges or allocations of government-owned land with individuals, corporations and/or municipalities simply for their convenience. Both city governments of Las Cruces and Anapra should not expect the BLM to continually adjust its management boundaries to provide land for their exclusive use. If the City of Las Cruces intends westward expansion, e.g., fair grounds, airport, etc. and BLM concurs with the city's plans, the land ought to be sold at a fair market price, not simply given to the city.

I would strongly endorse any of your plans for land exchanges, rights of way, etc., which make possible more effective and comprehensive land management units.

Minerals - Much more study is needed in the field of geothermal utilization before any national resource lands are earmarked specifically for that use. In spite of our current energy concerns, the amount of surface disturbance required for geothermal development cannot be justified at the present time. By forestalling development of these potential sources, the land is left natural and should development become imperative at a later date, the option is still open. However, immediate development might prove to be a mistake in light of the current state of the art in successfully utilizing geothermal energy.

Due to the past record of promiscuous mining claims at the slightest hint of the potential presence of some mineral, I would urge the tightening of mineral rights claiming procedures and strict enforcement of regulations currently on the books which regulate mining development.

Validity determinations should certainly be made on every claim in the entire Los Uves area. Any laxness shown by claimants in actively maintaining their claims should be considered as disinterest and the claims terminated.

Vegetative Products - The removal of any vegetative products should be done only under strictest control and only after the payment of a fair market value fee.

Livestock Forage - Ecological management of all range lands should be your first consideration. Any grazing allotments which have over used forage to the detriment of native vegetation should be quickly reviewed and necessary herd reductions made immediately. The general health of the range and its capacity for regeneration must be considered before the needs of individual permittees are considered. If you lose the top soil to over grazing, you lose everything.

With careful vegetation management and its consequent control of erosion, the city and county governments desiring land for flood control structures would be saved a great deal of expense. It would expect complete control but substantial runoff could be prevented.

I oppose vegetation manipulation which is contrived merely to benefit one special interest group unless the aim is to restore a pristine vegetation pattern. With this in mind, I do endorse wildfire, lightning caused or purposefully started as a management tool in carefully controlled situations.

Watershed - Watershed values and the amount of forage removed by grazing are directly related. Obviously any over-grazed areas are very poor for retention of moisture.

Any roads, trails and/or soil removal which accelerates surface erosion should be declared "closed" and strictly enforced. All roads, government or private, should be built in such a way as to bring minimal environmental impact in its broadest sense.

Recreation - In my estimation, ORV use is not a valid use for natural resource land. Once a given area is "used" by ORV's, it isn't of any value for other uses. ORV users should finance their own purchase of land. They should not use land that belongs to all of us for their single interest sport. Your recommendations # 15 and 16 are inconsistent with competent land management, in my opinion.

The Kilbourne Hole should be investigated for possible designation as a National Landmark. The Butterfield Trail and "Ft Mason" site should be reviewed and nominated for the National Register of Historic Places if they meet necessary criteria.

In light of the relative popularity of some areas, e.g., Kilbourne Hole, Potrillo Mts, for non-consumptive recreation, I would certainly urge the expanded signing program recommended. This would afford more people the opportunity to see and enjoy these areas, would greatly increase your ability to control use and above all enhance the experience for everyone.

I am aware of the traditional thinking which defines hunting as recreation, however, I don't agree with it. I don't feel the Federal Government should subsidize hunting of anything for the "recreation" of a few individuals. Hunters, like ORV users, should buy their own land, manage their own animals and finance their own brand of "recreation".

I am not personally acquainted with Kilbourne Hole area, but from photographs taken by friends and through conversation with them, it seems to me that an interpretive trail would be a successful development for that area. The unique erosion patterns, combined with the unusual vegetation, make Kilbourne Hole an exciting area for nature study. I understand also that one of the few Gila Monster sightings in the entire state of New Mexico was made there. I would strongly recommend any steps you can take to give this fragile area complete protection. Above all, keep out the ORV's.

Wildlife - I am convinced that management practices aimed at restoring pristine vegetation patterns and reduction of grazing levels will simultaneously enhance wildlife habitat, watershed values and most forms of non-consumptive recreation. I would caution the development of water facilities simply to increase wildlife and certainly provide a means of escape from drowning in every water tank. Also, that introduction of antelope to the West Potrillo Mountains is for eventual public hunting. Once again, let me emphasize that I will not endorse such a proposal simply to enhance hunting on public land. It seems to me that if the West Protrillo Range has suitable habitat for Pronghorn that the animals will find their way to this area naturally given enough time.

I whole heartedly concur with your recommendations which give added protection to the birds of prey. By all means, close any area to everyone if zone-tailed hawks are endangered. Where success seems probable, the erection of perch poles is an excellent idea.

Anything you can do along the Rio Grande which increases habitat for either Mexican Duck and/or Sandhill Cranes should be a high priority. Now that the cranes have been saved from extinction, constant vigilance will be necessary to maintain a few acres of their winter habitat to ensure the perpetuation of the birds.

I am delighted to see the BLM taking serious the need for public review of management plans. I appreciate the chance to be heard.

Sincerely,

George T. Morrison

George T. Morrison
Chief Naturalist

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

POST OFFICE BOX 1306
ALBUQUERQUE, NEW MEXICO 87103

RB

DEC 6 '74

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December 4, 1974

Memorandum

To: William K. Barker, Area Manager, Bureau of Land Management, Las Cruces-Lordsburg Resource Area, Las Cruces, New Mexico

From: Associate Regional Supervisor, Div. of River Basin Studies

Subject: Geothermal development--Lease applications for Kilbourne Hole area and Bureau of Land Management's Environmental Analysis Record (EAR)

This is in reference to the preliminary field survey of the Kilbourne Hole area on November 5 and 6, 1974, to gather background information for preparing your EAR prior to making lease agreements for geothermal exploration.

Mr. Don H. Rodgers of this office participated in the survey and discussed the project with you and your staff.

As requested by Mr. Gary McVicker a copy of a compilation of provisions of the Fish and Wildlife Coordination Act is enclosed. Our responsibility in relation to geothermal development is under the authority of and in accordance with the National Environmental Policy Act of 1969; the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.); the Endangered Species Act of 1973; and Secretarial Order No. 2962 dated February 6, 1974, as it relates to the Geothermal Steam Act of December 24, 1970.

As discussed by you and Mr. Rodgers, we too feel that the best avenue to insure minimum destruction of habitat on the area would be to insert language into the lease agreement that will allow us to monitor specific activities as planning develops. Review of the leasee's plans should be done as early in the planning as possible to allow adequate examination of alternatives, if necessary. This should reduce conflicts which often occur when recommendations are made after planning has been firmly formulated.

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Further examination of the area may reveal specific locations which should be protected or access should be limited. Protection should be provided for any unique habitat or other areas of special interest. Mr. Rodgers will contact you in January to pursue this investigation further.

We also would be interested in the improvement of existing roads and trails and the placement of new roads since these works could have a significant long-term impact on the environment.

The golden eagle is not considered an endangered species by the Fish and Wildlife Service but it is protected by federal law. One was seen flying over the proposed lease area. In addition, an old nest of a golden eagle was found in Aden Crater. Other craters may offer suitable sites for nesting. If this observation proves correct, the sites should be protected to the greatest extent possible. It is likely that suitable nesting sites are scarce in the area.

There are at least six species of endangered animals whose range includes the proposed lease area. This does not necessarily mean they regularly utilize the area, only that there is a possibility that they do. Habits and habitat requirements will of course determine the extent of use by any species. Still, the following species should be given special attention and consideration in the environmental analysis, because the are endangered.

The range of the Mexican duck, Anas diazi, includes the proposed lease area. It has been observed in the Rio Grande Valley from Caballo Lake southward in New Mexico. Due to the scarcity of surface water on the area it appears at this time that use of the area by the Mexican duck would be negligible. If this is the case then of course human activity would not be detrimental to this species.

The southern bald eagle, Haliaeetus l. leucocephalus, roams great distances and might occasionally be seen over the area during the winter. However, it more often is found near large bodies of water and would scarcely be seen on the area.

The American peregrine falcon, Falco peregrinus anatum, like the bald eagle has a wide distribution. The Latin name peregrinus means "a wanderer." It usually avoids close proximity to man and prefers habitat along streams and large bodies of water because waterfowl and shorebirds make up a sizeable portion of its diet. It also prefers to nest near water and thus would not likely be seen on any regular basis in the proposed lease area.

The prairie falcon, Falco mexicanus, may be seen wandering in winter anywhere in the State except the high forested mountains. It is most

common in the Pecos Valley. It would be the most likely of the three raptors to nest in the proposed lease area. Still, it is very selective as to nest sites, in that the bird invariably selects protected recesses or crevices in high perpendicular cliffs or canyon walls. It is possible that some of the sinks or volcanic craters might provide such nesting sites. If such sites are discovered they should be protected in accordance with the Endangered Species Act of 1973.

The spotted bat, Euderma maculatum, is found from the ponderosa pine belt to the Lower Sonoran Life Zone. It is a bat of high cliffs and canyons and is possibly selective of those of sedimentary origin. It lives in cracks and crevices during the day. It could possibly be found in a few locations on the area.

The Mexican wolf, Canis lupus baileyi, possibly could be found in the proposed lease area, which would be in the northern edge of its range. Most sightings have apparently been in the more rugged mountainous areas. They have been reported in the Animas Mountains in the extreme southwest corner of the state.

The Animas ridge-nosed rattlesnake, Crotalus willardi obscurus, is known to occur in the southwest corner of the state. It is not yet listed as endangered, but may be in the near future. The extent of its range is not known, but could conceivably include portions of the proposed lease area.

Although it will probably not be necessary to list in the EAR all species which may be found on the proposed lease area, it would be desirable to maintain a record of animals actually seen.

Animals and animal signs seen on the field survey are listed below. A question mark means identification was not positive.

Estimated 100 ducks at
  at Hunt's Hole
Turkey vulture
Cooper's hawk?
Red-tailed hawk
Golden eagle
Marsh hawk
Sparrow hawk
Scaled quail
Mourning dove
Roadrunner
Horned lark

Mountain chickadee
Rock? wren
Crissal thrasher?
Loggerhead shrike
Western meadowlark
Lark bunting
Vesper sparrow
Oregon? junco

Horned lizard

Desert cottontail

Gopher or mole diggings
Woodrat nests
Kangaroo rat nests
Badger hole & scats?
Coyote tracks
Deer tracks with young
Mule deer hide

Cactus wren? nest
Golden eagle nest (old)

Members of your staff will of course be able to add to this list. Mr. McVicker undoubtedly knows most of the reptiles and amphibians which can be found on the area.

The EAR should of course consider game species on the area. Mule deer, scaled quail, dove, waterfowl, and possibly a small herd of antelope are found on the lease site.

The herd of antelope is near the northern perimeter of the lease area and is not likely to be affected.

Waterfowl use is undoubtedly very limited but approximately 100 ducks were seen on our field trip in Hunt's Hole where higher than normal rainfall had formed a shallow pool.

Deer utilize the area and are evidently hunted. It was indicated that the Aden Crater malpais provided relatively good habitat.

Both dove and quail are hunted on the area. It is probable that water is their primary limiting factor and that populations could be increased with more permanent water. If geothernal development becomes a reality on the area, construction of small watering areas in scattered locations should be incorporated in the project plan. This could be accomplished from water lines by delivery of as little as 1,800 gallons per day to small fenced enclosures. Song birds and other species of wildlife also would benefit from improved availability of watering sites.

To the best of our knowledge there is no fish habitat in the lease area.

We assume that a cover map of the proposed lease area could be prepared by your staff from existing data. It would be of value in preparing the EAR, since it would give an overall picture of the environment. It would also provide historical evidence for future reference.

The potential for range fires will increase as men and equipment move in to the area for exploration and development. Portions of the area contain grassland which could carry a fire over a large portion of the range. Thus, a program for fire control should receive emphasis in the lease agreement.

This office will continue to provide assistance as needed during the preparation of the EAR. As mentioned, we are particularly interested in the wording of any lease agreement where it relates to environmental protection. We would like to monitor, review, and coordinate ideas through each step of geothermal exploration, development, and operation.

Such close coordination will allow us to make the best possible recommendations for habitat preservation while being consistent with geothermal development plans.

Enclosure

Fish and Wildlife Coordination Act*

The following compilation of provisions of the Fish and Wildlife Coordination Act has been prepared for convenient reference:

SEC. 1. For the purpose of recognizing the vital contribution of our wildlife resources to the Nation, the increasing public interest and significance thereof due to expansion of our national economy and other factors, and to provide that wildlife conservation shall receive equal consideration and be coordinated with other features of water-resource development programs through the effectual and harmonious planning, development, maintenance, and coordination of wildlife conservation and rehabilitation for the purposes of this Act in the United States, its Territories and possessions, the Secretary of the Interior is authorized (1) to provide assistance to, and cooperate with, Federal, State, and public or private agencies and organizations in the development, protection, rearing, and stocking of all species of wildlife, resources thereof, and their habitat, in controlling losses of the same from disease or other causes, in minimizing damages from overabundant species, in providing public shooting and fishing areas, including easements across public lands for access thereto, and in carrying out other measures necessary to effectuate the purposes of this Act; (2) to make surveys and investigations of the wildlife of the public domain including lands and waters or interests therein acquired or controlled by any agency of the United States; and (3) to accept donations of land and contributions of funds in furtherance of the purposes of this Act.

SEC. 2. (a) Except as hereafter stated in subsection (h) of this section, whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose whatever, including navigation and drainage, by any department or agency of the United States, or by any public or private agency under Federal permit or license, such department or agency first shall consult with the United States Fish and Wildlife Service, Department of the Interior, and with the head of the agency exercising administration over the wildlife resources of the particular State wherein the impoundment, diversion, or other control facility is to be constructed, with a view to the conservation of wildlife resources by preventing loss of and damage to such resources as well as providing for the development and improvement thereof in connection with such water-resource development.

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*The Act of March 10, 1934, 48 Stat. 401, as amended by the Act of August 14, 1946, 60 Stat. 1080; the Act of June 19, 1948, 62 Stat. 497; the Act of August 12, 1958, 72 Stat. 563; 16 U. S. C. 661 et seq., and the Act of July 9, 1965, 79 Stat. 213.

The Act of August 12, 1958 established the official title of this legislation as the "Fish and Wildlife Coordination Act"; it also revised the first four sections of the legislation and contains an authorization for appropriations.

(b) In furtherance of such purposes, the reports and recommendations of the Secretary of the Interior on the wildlife aspects of such projects and any report of the head of the State agency exercising administration over the wildlife resources of the State, based on surveys and investigations conducted by the United States Fish and Wildlife Service and such State agency for the purpose of determining the possible damage to wildlife resources and for the purpose of determining means and measures that should be adopted to prevent the loss of or damage to such wildlife resources, as well as to provide concurrently for the development and improvement of such resources, shall be made an integral part of any report prepared or submitted by any agency of the Federal Government responsible for engineering surveys and construction of such projects when such reports are presented to the Congress or to any agency or person having the authority or the power, by administrative action or otherwise, (1) to authorize the construction of water-resource development projects or (2) to approve a report on the modification or supplementation of plans for previously authorized projects, to which this Act applies. Recommendations of the Secretary of the Interior shall be as specific as is practicable with respect to features recommended for wildlife conservation and development, lands to be utilized or acquired for such purposes, the results expected, and shall describe the damage to wildlife attributable to the project and the measures proposed for mitigating or compensating for these damages. The reporting officers in project reports of the Federal agencies shall give full consideration to the report and recommendations of the Secretary of the Interior and to any report of the State agency on the wildlife aspects of such projects, and the project plan shall include such justifiable means and measures for wildlife purposes as the reporting agency finds should be adopted to obtain maximum overall project benefits.

(c) Federal agencies authorized to construct or operate water-control projects are hereby authorized to modify or add to the structures and operations of such projects, the construction of which has not been substantially completed on the date of enactment of the Fish and Wildlife Coordination Act, and to acquire lands in accordance with section 3 of this Act, in order to accommodate the means and measures for such conservation of wildlife resources as an integral part of such projects: Provided, That for projects authorized by a specific Act of Congress before the date of enactment of the Fish and Wildlife Coordination Act (1) such modification or land acquisition shall be compatible with the purposes for which the project was authorized; (2) the cost of such modifications or land acquisition, as means and measures to prevent loss of and damage to wildlife resources to the extent justifiable, shall be an integral part of the cost of such projects; and (3) the cost of such modifications or land acquisition for the development or improvement of wildlife resources may be included to the extent justifiable, and an appropriate share of the cost of any project may be allocated for this purpose with a finding as to the part of such allocated cost, if any, to be reimbursed by non-Federal interest.

(d) The cost of planning for and the construction or installation and maintenance of such means and measures adopted to carry out the conservation purposes of this section shall constitute an integral part of the cost of such projects: Provided, That such cost attributable to the development and improvement of wildlife shall not extend beyond that necessary for (1) land acquisition, (2) facilities as specifically recommended in water resource project reports, (3) modification of the project, and (4) modification of project operations, but shall not include the operation of wildlife facilities.

(e) In the case of construction by a Federal agency, that agency is authorized to transfer to the United States Fish and Wildlife Service, out of appropriations or other funds made available for investigations, engineering, or construction, such funds as may be necessary to conduct all or part of the investigations required to carry out the purposes of this section.

(f) In addition to other requirements, there shall be included in any report submitted to Congress supporting a recommendation for authorization of any new project for the control or use of water as described herein (including any new division of such project or new supplemental works on such project) an estimation of the wildlife benefits or losses to be derived therefrom including benefits to be derived from measures recommended specifically for the development and improvement of wildlife resources, the cost of providing wildlife benefits (including the cost of additional facilities to be installed or lands to be acquired specifically for that particular phase of wildlife conservation relating to the development and improvement of wildlife), the part of the cost of joint-use facilities allocated to wildlife, and the part of such costs, if any, to be reimbursed by non-Federal interests.

(g) The provisions of this section shall be applicable with respect to any project for the control or use of water as prescribed herein, or any unit of such project authorized before or after the date of enactment of the Fish and Wildlife Coordination Act for planning or construction, but shall not be applicable to any project or unit thereof authorized before the date of enactment of the Fish and Wildlife Coordination Act if the construction of the particular project or unit thereof has been substantially completed. A project or unit thereof shall be considered to be substantially completed when sixty percent or more of the estimated construction cost has been obligated for expenditure.

(h) The provisions of this Act shall not be applicable to those projects for the impoundment of water where the maximum surface area of such impoundments is less than ten acres, nor to activities for or in connection with programs primarily for land management and use carried out by Federal agencies with respect to Federal lands under their jurisdiction.

SEC. 3. (a) Subject to the exceptions prescribed in section 2 (h) of this Act, whenever the waters of any stream or other body of water are impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose whatever, including navigation and drainage, by any department or agency of the United States, adequate provision,

consistent with the primary purposes of such impoundment, diversion, or other control, shall be made for the use thereof, together with any areas of land, water, or interests therein, acquired or administered by a Federal agency, in connection therewith, for the conservation, maintenance, and management of wildlife resources thereof, and its habitat thereon, including the development and improvement of such wildlife resources pursuant to the provisions of section 2 of this Act.

(b) The use of such waters, land, or interests therein for wildlife conservation purposes shall be in accordance with general plans approved jointly (1) by the head of the particular department or agency exercising primary administration in each instance, (2) by the Secretary of the Interior, and (3) by the head of the agency exercising the administration of the wildlife resources of the particular State wherein the waters and areas lie. Such waters and other interests shall be made available, without cost for administration, by such State agency, if the management of the properties relate to the conservation of wildlife other than migratory birds, or by the Secretary of the Interior, for administration in such manner as he may deem advisable, where the particular properties have value in carrying out the national migratory bird management program: Provided, That nothing in this section shall be construed as affecting the authority of the Secretary of Agriculture to cooperate with the States or in making lands available to the States with respect to the management of wildlife and wildlife habitat on lands administered by him.

(c) When consistent with the purposes of this Act and the reports and findings of the Secretary of the Interior prepared in accordance with section 2, land, waters, and interests therein may be acquired by Federal construction agencies for the wildlife conservation and development purposes of this Act in connection with a project as reasonably needed to preserve and assure for the public benefit the wildlife potentials of the particular project area: Provided, That before properties are acquired for this purpose, the probable extent of such acquisition shall be set forth, along with other data necessary for project authorization, in a report submitted to the Congress, or in the case of a project previously authorized, no such properties shall be acquired unless specifically authorized by Congress, if specific authority for such acquisition is recommended by the construction agency.

(d) Properties acquired for the purposes of this section shall continue to be used for such purposes, and shall not become the subject of exchange or other transactions if such exchange or other transaction would defeat the initial purpose of their acquisition.

(e) Federal lands acquired or withdrawn for Federal water-resource purposes and made available to the States or to the Secretary of the Interior for wildlife management purposes, shall be made available for such purposes in accordance with this Act, notwithstanding other provisions of law.

(f) Any lands acquired pursuant to this section by any Federal agency within the exterior boundaries of a national forest shall, upon acquisition, be added to and become national forest lands, and shall be administered as a part of the forest within which they are situated, subject to all laws applicable to lands acquired under the provisions of the Act of March 1, 1911 (36 Stat. 961), unless such lands are acquired to carry out the National Migratory Bird Management Program.

SEC. 4. Such areas as are made available to the Secretary of the Interior for the purposes of this Act, pursuant to sections 1 and 3 or pursuant to any other authorization, shall be administered by him directly or in accordance with cooperative agreements entered into pursuant to the provisions of the first section of this Act and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon, as may be adopted by the Secretary in accordance with general plans approved jointly by the Secretary of the Interior and the head of the department or agency exercising primary administration of such areas: Provided, That such rules and regulations shall not be inconsistent with the laws for the protection of fish and game of the States in which such area is situated (16 U.S.C., sec. 664): Provided further, That lands having value to the National Migratory Bird Management Program may, pursuant to general plans, be made available without cost directly to the State agency having control over wildlife resources, if it is jointly determined by the Secretary of the Interior and such State agency that this would be in the public interest: And provided further, That the Secretary of the Interior shall have the right to assume the management and administration of such lands in behalf of the National Migratory Bird Management Program if the Secretary finds that the State agency has withdrawn from or otherwise relinquished such management and administration.

SEC. 5. The Secretary of the Interior, through the Fish and Wildlife Service and the Bureau of Mines, is authorized to make such investigations as he deems necessary to determine the effects of domestic sewage, mine, petroleum, and industrial wastes, erosion silt, and other polluting substances on wildlife, and to make reports to the Congress concerning such investigations and of recommendations for alleviating dangerous and undesirable effects of such pollution. These investigations shall include (1) the determination of standards of water quality for the maintenance of wildlife; (2) the study of methods of abating and preventing pollution, including methods for the recovery of useful or marketable products and byproducts of wastes; and (3) the collation and distribution of data on the progress and results of such investigations for the use of Federal, State, municipal, and private agencies, individuals, organizations, or enterprises.

SEC. 5A. In the management of existing facilities (including locks, dams, and pools) in the Mississippi River between Rock Island, Illinois, and Minneapolis, Minnesota, administered by the United States Corps of Engineers of the Department of the Army, that Department is hereby directed to give full consideration and recognition to the needs of fish and other wildlife resources

and their habitat dependent on such waters, without increasing additional liability to the Government, and, to the maximum extent possible without causing damage to levee and drainage districts, adjacent railroads and highways, farm lands, and dam structures, shall generally operate and maintain pool levels as though navigation was carried on throughout the year.

SEC. 6. There is authorized to be appropriated from time to time, out of any money in the Treasury not otherwise appropriated, such amounts as may be necessary to carry out the provisions of this Act and regulations made pursuant thereto, including the construction of such facilities, buildings, and other improvements necessary for economical administration of areas made available to the Secretary of the Interior under this Act, and the employment in the city of Washington and elsewhere of such persons and means as the Secretary of the Interior may deem necessary for such purposes.

SEC. 7. Any person who shall violate any rule or regulation promulgated in accordance with this Act shall be guilty of a misdemeanor and upon conviction thereof shall be fined not more than $500 or imprisoned for not more than one year, or both.

SEC. 8. The terms "wildlife" and "wildlife resources" as used herein include birds, fishes, mammals, and all other classes of wild animals and all types of aquatic and land vegetation upon which wildlife is dependent.

SEC. 9. The provisions of this Act shall not apply to the Tennessee Valley Authority.

APPENDIX G

FROM: GemCrafters & Explorers Club

Mr. LeRoy J. Unglaub
1610 San Acacio Street
Las Cruces, N. Mex. 88001

Tel No. Home 524-9497
Work 678-2261

LAS UVAS PLANNING UNIT (LUPU)

PUBLIC PARTICIPATION SHEET

MAR 24

RESOURCE ACTIVITY Recreation

RECOMMENDATION NO. General Comments

COMMENTS The following are general comments and do not pertain to any one recommendation and are ~~the~~ their general feelings of the membership of the Gemcrafters and Explorers Club — a rock hound club with about 60 members.

Background — Rockhounding is a major recreational activity in the Las Cruces area with an estimated 300-500 or more participants — of which only 100-120 belong to formal clubs. This number will be much greater if El Paso and surrounding towns are included. About one half of these persons are retired and a large percentage of the remainder are close to retirement age.

Comments:

1. Rockhounding should be specifically designated as a recreational activity.

2. This club concurs with the concept of multiple land use. The LUPU should not

continued in attached sheets

LeRoy J Unglaub 20 Mar. 75
Signature Date
for GemCrafters & Explorers Club

be restricted to anyone single interest group.

3. Kilbourne Hole and area should be closed to ORV races and other events. However, roads to Kilbourne Hole should be left open for sightseeing, study ~~and~~, rockhounding and other recreational uses. Kilbourne Hole and the general area is important because of its geology and it is the only known location in southern New Mexico where the mineral peridot can be collected. Commercial rock collecting should be banned at Kilbourne Hole.

4. Concur with the set aside of two areas for ORV use and events -- Box Canyon area and another area in the southern part of the LUPU - but not Kilbourne Hole.

5. The majority of roads and trails in the LUPU should be left open for sightseeing and to get access to the area for hiking, rockhounding and other recreational purposes. Because of the average age of rockhounds they can not walk or hike great distances - and closing of roads in the LUPU will deny them and other older persons any use of the area for any purpose.

con't

6. Concur with mineral, gas, oil and geothermal exploration in the LUPU except for areas specifically set aside for other purposes. The scarcity of mineral and energy resources must be considered. The environmental impact must be controlled during the exploration and any resulting resource extraction activities.

7. Concur with the establishment of a rifle range, park, fairground, etc, in the planning unit, Concur with the ban of firearms in the area,

8. Concur with limited and controlled collection of plants, cinder and lava materials at designated areas.

9. Archeological and rock art sites should be preserved to the max. extent practical, but still allow controlled access to these areas. If they cannot be preserved for some reason, they should be recorded and/or salvaged prior to destruction.

10. Cross country travel (not on established roads or trails) should be limited,

11. ORV use should be allowed on existing roads (improved or unimproved) & trails to allow access to the area. This does not include ORV races and events - just use of the roads

LeRoy J [illegible]

MAR 2

LAS UVAS PLANNING UNIT

PUBLIC PARTICIPATION SHEET

RESOURCE ACTIVITY interested in all aspects

RECOMMENDATION NO. ________

COMMENTS I am aware that my comments are not made with any one activity in mind — I am most interested in the best use of our heritage for the most life (human, animal & plant) for the next thousand years — and more! With this as a "long view", I strongly support:

(1) Study of the West Potrillos as a possible primitive area
(2) Study of the Aden Lava Flow as a possible research natural area
(3) Protection of the primitive & back-country value of the Las Uvas Mountains.
4) Proper management in geothermal exploration, road building, mining, drilling and [illegible] of other natural and wildlife areas. and carving
(5) Designation of the use areas for ORVs that will not adversely affect primitive, natural and wildlife areas & watersheds.

These seem to me minimum requirements as starters to prevent damage, destruction and misuse of this, our land.

Florence Wurgler 3/20/75
Signature Date

Mrs. Nelson Wurgler

MICHAEL J. BILBO
928 - RAILROAD #41
EL PASO, TEXAS

MAR 2

LAS UVAS PLANNING UNIT

PUBLIC PARTICIPATION SHEET

RESOURCE ACTIVITY LANDS,

RECOMMENDATION NO. 1-8

COMMENTS my prime interest in the Las Uvas planning unit is archaeological resources and it is in this context that I write. I'm sure you are well aware of Federal Law requiring evaluation of historic and prehistoric values prior to man-directed alteration and/or development on federal lands or where federal funds are involved. I am a native of El Paso and a student of archaeology. at this time however I am in the army and am stationed at Ft Bliss. It is my intention of one day becoming a professional archaeologist. I have worked in the greater El Paso - Las Cruces - Northern Chihuahua area on numerous archaeological surveys and digs both as an amateur and semi-professional. I am especially interested in the Uvas planning unit, as, for the past year, I have (OVER)

Michael J Bilbo
Signature

18 MAR 75
Date

LAS UVAS PLANNING UNIT

PUBLIC PARTICIPATION SHEET

RESOURCE ACTIVITY LANDS

RECOMMENDATION NO. 1-8

COMMENTS in 1977 on Eastern Range, Ft Bliss Military Reservation and ~~[illegible]~~ within the El Paso city limits, no impact statement was prepared. ~~[illegible] [illegible] [illegible] known~~ a large archaeological site had been known in the area since 1964 but no one bothered to notify governmental agencies until the last minute. Fortunately enough funds for a hasty investigation were available and an expert team from U.T. Austin came down. The site was found to be so ~~[illegible]~~ significant that it was entered on the National Register of Historic Places and is now protected. ~~[illegible]~~ 2 and 3 - two projects in the Cruces area made funds available but only at the last minute again only a hasty study was ~~[illegible]~~ conducted and the resulting finds were not as significant as they probably really were. These sites are now destroyed (within the past two years). The foregoing information was presented to show the need for (OVER)

Michael J. Bilbo
Signature

18 MAR 75
Date

an early and more complete survey / study.

RECOMMENDATION # 4

In light of the needs of the city of Las Cruces, I would support # 4, however surveys should be conducted as soon as possible on proposed locations of these facilities.

RECOMMENDATION # 5

I support # 5 (access should be controlled however by something like a key register).

RECOMMENDATION #6

I support #6. Historic values (the old railroad sidings and towns) should be considered for preservation and interpretation. at Noria Station there used to be a classic example of a two-story railroad official's house. this was last seen in 1971 as someone burned it down. Evidence in the form of large amounts of litter and tracks indicates the blame may rest on an ORV group (car/truck only).

RECOMMENDATION #8

I support this; an archaeological survey should be conducted along this line as it is a good area transection.

been hiking more and more in that area. I therefore offer the following information and suggestions for your consideration.

LANDS:

RECOMMENDATION #1 -

Because of recommendation #2 I support recommendation #1 however an archaeological survey should be immediately sought for the proposed areas. All to often there is a tendency for agencies and officials to wait until the last minute thus making for a hasty and incomplete job. I do consider the necessary negotiations and administrative tasks involved but an early start takes this well into account. There are many significant sand dune sites or bluffs above the Rio Grande where the Indians made use of three ecotones for survival: the river, desert, and transition zone between.

RECOMMENDATION #3 -

Funds are usually available right away for flood control projects. Many flood control projects, be it Federal or otherwise have grossly ~~or~~ overlooked, neglected and ignored archaeological potentials prior to development. In the case of Federal projects the government is supposed to ~~warn~~ ~~[illegible]~~ be aware of these values and take proper measures. Three notable projects come to mind on this subject: ① when the U.S. Army Corps of Engineers began to build flood retention dams.

LAS UVAS PLANNING UNIT

PUBLIC PARTICIPATION SHEET

RESOURCE ACTIVITY MINERALS

RECOMMENDATION NO. 1-3

COMMENTS RECOMMENDATION #1 -

• all mineral entries should be closely monitored such that they would not significantly affect other natural values such as wildlife, wilderness and scenic and such values as archaeology and history. ~~[illegible]~~ ~~suggest~~ the geothermal potential should be carefully and thoroughly researched while taking care to notice other values.

RECOMMENDATION #2 -

A. the Las Uvas area needs a ~~thou~~ thorough archaeological and historical survey. the high incidence of rock art sites in the Doña Ana Mountains, while out of the planning unit, nevertheless indicates an equally high potential of same in the Las Uvas area. Some very small arroyos and ~~a~~ otherwise ~~une~~ unnoticeable have produced some very significant prehistoric rock art.

B. this mountain area should be evaluated fully as a ~~[illegible]~~ potential cougar habitat prior to 6...

Michael J. F[illegible] Signature 18 MAR 75 Date

development. an archaeological survey is also needed.

C. Kilbourne Hole should be examined as a possible geothermal source however care should be taken so as not to disturb its natural scenic value. Rock art is known to exist in the Hole but has not been recorded. I really do not favor geothermal leasing but in the future it may be a needed commodity.

RECOMMENDATION #3

I do not support #3 as this policy favors an anti-environmental ethic. energy exploration should take precedence over this form of mineral entry as should all other natural and cultural values. if this type of entry becomes available it would certainly affect wildlife habitats (and I'm speaking even of insects which form an integral part of the desert habitat), not to mention scenic and cultural (professional rock art locators are at work at Cook's Peak and most recently at the Alamo Mountain Rock Art Site) values. this form of entry if it occurs should be strictly regulated and should cost money for removal. Blow sand is known to contain all aspects of the prehistoric area cultures, most notably: Early Man.

IT IS ESPECIALLY IMPORTANT THAT ANY PROPOSED MINERAL REMOVAL AREAS BE SURVEYED FOR ROCK ART.

LAS UVAS PLANNING UNIT

PUBLIC PARTICIPATION SHEET

RESOURCE ACTIVITY LANDS

RECOMMENDATION NO. 4, 6

COMMENTS RECOMMENDATION # 4 –

• I do not support #4 because of large known and reported, significant archaeological sites in all these areas. Further the Aden Lava Flow should be classified as a Research Natural area. It has been brought to my attention that there are several lava tubes and other rare volcanic formations in the flow. Study of zoological and biological values restricted to these tubes may be very important. NOTE There are many natural shelters in the flow containing ~~human~~ past human cultural remains and rock art. If parts of the flow must be sold let it be for something tangible like cinder blocks and not decorative stones.

RECOMMENDATION #6

The El Paso Archaeological Society has located some very significant prehistoric sites (mainly pueblo) in areas closely bordering the East Potrillos especially at the southern end. Some of these sites are high while others surround the several (over)

Signature

19 MAR 75
Date

plays in the area. A comprehensive archeological survey of the area is needed. The foregoing IS A CONFLICT as far as my input is ~~con~~ concerned.

RESOURCE ACTIVITY: TIMBER AND OTHER VEGETATIVE PRODUCTS

I agree with recommendation #1 and very strongly support #2.

RESOURCE ACTIVITY: LIVESTOCK FORAGE

RECOMMENDATION #10

I support #10 fully.

RECOMMENDATION #11

I support #11 fully.

RECOMMENDATION #12

I support #12 fully.

RESOURCE ACTIVITY: WATERSHED

RECOMMENDATION #1 –

Root plowing will require a comprehensive archeological survey. This form of vegetative control if culturally unchecked would destroy many potential archeological resources. This should be considered an additional conflict.

RECOMMENDATION #2 –

I fully support #2.

LAS UVAS PLANNING UNIT

PUBLIC PARTICIPATION SHEET

RESOURCE ACTIVITY WATERSHED

RECOMMENDATION NO. 3

COMMENTS I support #3. as previously mentioned blow sand invariably contains the entire spectrum of primitive and early historical man within its dunes – reflected by his artifacts

RECOMMENDATION #4

archaeological surveys will be needed.

RESOURCE ACTIVITY: RECREATION

RECOMMENDATION #1

I support #1

RECOMMENDATION #2

I support #2

RECOMMENDATION #3

I most whole heartedly support #3, as you have seen archaeology plays an important role in determining resource values of the planning unit. You are probably aware of the following groups which can be of significant assistance: (OVER).

Michael J. Bilbo
Signature

19 MAR 75
Date

EL PASO CENTENNIAL MUSEUM, UNIVERSITY OF TEXAS AT EL PASO
CONTRACT ARCHAEOLOGISTS AVAILABLE; REX GERALD, HERB MORROW, TOM O'LAUGHLIN
PHONE: (915) 747-5565

NEW MEXICO STATE UNIVERSITY
CONTRACT ARCHAEOLOGIST : PAT BECKETT

CENTER OF ANTHROPOLOGICAL STUDY (COAS)
COAS PUBLISHING AND RESEARCH, PAT BECKETT, DIRECTOR
1720 SACRAMENTO - LAS CRUCES, N.M. 88001 PHONE 524-8254

EL PASO ROCK ART RESEARCH SOCIETY (doing some impressive research and with whom I am involved primarily) ANTHROPOLOGIST AVAILABLE : KAY SUTHERLAND at EL PASO COMMUNITY COLLEGE. HOME PHONE (915) 772-68

EL PASO ARCHAEOLOGICAL SOCIETY (AMATEUR ORIENTED) EXPERIENCED AMATEURS AVAILABLE. PRESIDENT - JOHN V. DAVIS HOME PHONE (915) 755-3757

LAS CRUCES ARCHAEOLOGICAL SOCIETY - CONTACT PAT BECKETT (AMATEUR ORIENTED)

RECOMMENDATION # 4
I support # 4
RECOMMENDATION # 5
I support # 5

LAS UVAS PLANNING UNIT

PUBLIC PARTICIPATION SHEET

RESOURCE ACTIVITY RECREATION

RECOMMENDATION NO. 6, *

COMMENTS Kilbourne Hole has definite natural area values in the form of geological, archaeological, scenic, zoological and biological. ORV use should be off limits. Artefact collecting should be discouraged. A rifle range for Las Cruces at this location would absolutely ruin the effect of such a natural area. Please preserve it.

RECOMMENDATION #7 -

obviously I do not support ORV'S, however, if many other areas are put off limits a pressure relief area may be needed. This concept seems proper, however an archaeological survey is needed as soon as possible if not sooner as the area is already heavily utilized by ORV'S. ARCHAEOLOGICAL POTENTIAL IS A CONFLICT in this context only. Large intact archaeological and historical sites are in the northern Robledos (you will soon receive some survey reports). This area should be (OVER)

Michael J Bilbo
Signature

19 MAR 75
Date

further studied and protected although you make no recommendation concerning it. Historic military roads in the area should be off limits to ORV'S.

RECOMMENDATION # 8

I do not support #8 as it may upset environmental equilibrium in the area as such.

RECOMMENDATION # 9

I do not support #9 in view of wildlife recommendations.

RECOMMENDATION # 10

I support # 10

RECOMMENDATION # 11

It is against New Mexico state law as well as National Law to alter or destroy sites of significant historical value, applicable to Ft. Union. I believe it is administratively protected as being on the National Register of Historic Places. I therefore support most fully # 11.

RECOMMENDATION # 12

I support #12

RECOMMENDATION # 14

I recommend a scenic easement corridor be constructed (fenceline) to protect other resource activity interests. Historic settlements along the route would probably qualify for entry of the National Register of Historic Places; they should be preserved and their significance interpret through research. A locked gate and key register system should be instituted for those wishing to view such features as Indian Basin, etc.

LAS UVAS PLANNING UNIT

PUBLIC PARTICIPATION SHEET

RESOURCE ACTIVITY RECREATION

RECOMMENDATION NO. 16

COMMENTS I emphatically do not support #15 for reasons mentioned above and in view of conflicts 2, 3 and 4

RECOMMENDATION #18

I support #18 for reasons mentioned above and for the fact that archaeological sites exist (some having been excavated) in the northern Uvas and rock art has been reported but not recorded in the southern Uvas.

RECOMMENDATION #19

I support #19. A comprehensive archaeological survey involving all ~~#~~ facets of the discipline is needed for the whole Portrillo group.

RECOMMENDATION #20

I support #20

RESOURCE ACTIVITY: WILDLIFE

RECOMMENDATIONS 1-27

I most full-heartedly and strongly support every of wildlife recommendation.

Michael J. Bilbo 19 MAR 75

Signature Date

MAR 25 '75

LAS UVAS PLANNING UNIT

PUBLIC PARTICIPATION SHEET

RESOURCE ACTIVITY Minerals

RECOMMENDATION NO.

COMMENTS Under no circumstances should the West Potrillo Mountains and the Las Uvas Mountains be designated as primitive areas. This nation's number one problem is energy -- not recreation. Someone in the Department of the Interior seems to have lost touch with reality for there seems to be an edict stating that most federal lands must become parks and playgrounds. The nation's unemployment problem is directly related to our energy requirements, and establishing playgrounds in potential geothermal belts appears to border on the ridiculous.

Designating primitive areas close to large population centers as the Las Cruces-El Paso area will create a management problem unparalleled in BLM history. Already the Forest Service is initiating a permit system to begin during 1976 in the Gila Wilderness. An area can be trampled to death just as easily as it can be motored out of existence. Setting aside specific areas for hiking only can create the same problems that exist where any large groups participate in any activity. Recently, the Forest Service in Silver City revealed problems of this nature that arose in the vast expanse of the Gila Wilderness. Creating a primitive area out of the relatively small lands in the West Potrillo and Las Uvas Mountains can only multiply these problems manyfold, especially since they are so near population centers.

A close scrutiny of the unemployment statistics can reveal that man

LAS UVAS PLANNING UNIT

PUBLIC PARTICIPATION SHEET

RESOURCE ACTIVITY Minerals, Page Two

RECOMMENDATION NO.

COMMENTS is also an endangered species. Perhaps too much emphasis is placed on the Mexican duck and not enough on the U. S. citizen when it comes to utilization of public lands. The Preamble of the Constitution definitely asks that we promote the general welfare, not one line of the document is devoted to ducks of any species.

Signature

3-18-75
Date

BLM
LAS CRUCES
APR 1 '75
DM
ADM
RM
OPR
WS
RC-L ✓
ACTION

LAS UVAS PLANNING UNIT

PUBLIC PARTICIPATION SHEET

RESOURCE ACTIVITY Las Uvas Planning Unit,

RECOMMENDATION NO.

COMMENTS 1. In re to West Potrillo Mtns: I recommend continued study and support for this area to be designated as a primitive area — this area largely undeveloped.

2. In re to geothermal exploration I support the concept that such test drilling be limited to the area East of the Mt Riley area and outside of other natural and wildlife areas. I believe this is entirely possible based on conversations with Dr. Chandler Schwanberg, NMSU, Geophysics

3. Specific use areas should be set aside for RV's that preclude damage to the unique aspects of the Las Uvas area.

John T Bowen 25 Mar 5
Signature Date
6228 Constellation Dr
El Paso, Tex 79912

②

LAS UVAS PLANNING UNIT

PUBLIC PARTICIPATION SHEET

RESOURCE ACTIVITY

RECOMMENDATION NO.

COMMENTS

④ I support the designation of the ADEN Lava Flow as a natural research area.

⑤ I urge protection of the backcountry and primitive values of the Las UVas Mountains.

⑥ I hope the grasslands will receive first class management — the area generally looks pretty scruffy and overgrazing is always a danger in this area. Vegetative manipulation seems uncalled for — let's move the exotic species (cattle) where the grassland is rather than try to bring the grass to the cows.

Thanks for this opportunity to comment.

Signature John T Bowen

Date 25 mar 75

Guadalupe Wilderness Committee
3500 SUN BOWL DR. #24 EL PASO, TEXAS 79902

MAR 2[illegible]

DM
I
R

March 26, 1975

William K. Barker
District Manager
Bureau of Land Management
P.O. Box 1420
Las Cruces, N.M. 88001

Dear Mr. Barker:

Re: Las Uvas Planning Unit Management Framework Plan

The Guadalupe Wilderness Committee (GWC) is an organization of some 1500 citizen-conservationists concentrated in Southern New Mexico and Southwest Texas concerned with use and management of federal lands in the area. As our name implies, while we are concerned with all aspects of land use, our primary focus is the preservation of primitive, backcountry and wilderness values.

We see the MFP for the Las Uvas Planning Unit as being critical because: A) the Unit contains some of the most important de facto primitive areas in New Mexico, and B) parts of the Unit are being subjected to extreme developmental pressures (e.g., urban expansion in the Anapra and Las Cruces areas, unregulated and destructive ORV use, and potentially massive geothermal activity).

We recognize the need for the various multiple use activities in the Unit, and, based on past experience, we look forward to a wise and balanced management plan for all Unit resources. Our specific concern, however, centers around the following:

We would like to see formal Primitive Area status for the West Potrillo Mountains. We understand that the area proposed for study (as shown on the Recreation Overlay) contains approximately 70,000 acres. Our field and boundary work, however, indicates that a somewhat larger area qualifies and therefore should be studied. This larger area extends roughly five miles further west and four to five miles further south than the current Overlay boundary. We will submit our proposed boundary prior to the April, 1975 public hearings. (Would you kindly supply us with the dates for these hearings at your earliest convenience?)

We also strongly support the protection of backcountry and primitive values in the Las Uvas Mountains. We certainly oppose any additional

3500 SUN BOWL DR. #24 EL PASO, TEXAS 79902

development in this area and/or the upgrading of any roads (e.g., the Horse Canyon Road). Further, our preliminary studies indicate several 5,000+ acre roadless areas that may qualify for formal Primitive Area status. Again, we will try to provide exact boundaries prior to the April hearings.

We support the conservationist (and BLM?) proposal to restrict current geothermal leasing and exploration in the Kilbourne Hole geothermal lease area to already impacted areas east of Mt. Riley with the north-south line running from the International Boundary to I-10. Excluded also would be natural study areas such as the Aden Lava Flow and the East Potrillo Mountains. We further urge zealous care be taken by the BLM to protect the environment from the many adverse impacts that could result as detailed in the draft EAR on the subject.

We oppose the use of herbicides (especially 2-4-D) for use in any vegetative manipulation projects, and we would appreciate any information you could supply on successful vegetative treatment by other means on similar semi-arid lands.

Reports from various naturalists and scientists indicate that approximately 22,000 acres in the Aden Lava Flow qualify as a Research Natural Area under Bureau regulations, and we urge that the area be managed as such. We do not feel that ORV activity is compatible and would urge that all ORV-type roads in the Flow be closed.

Finally, we support the general notion of having specific areas for intensive ORV use and further restricting ORV activity to existing roads and possibly certain large canyon bottoms. We are in the process of inventoring some of these areas now and will submit our comments in the near future. Obviously we urge that all areas under study for primitive and natural values be completely closed to ORV use.

We appreciate the opportunity to offer these general comments regarding the MFP for the Las Uvas Unit, and we plan to submit more detailed recommendations as our field work and the planning process continues.

Sincerely,

Gayle Eads

GAYLE EADS
(Mrs. John S. Eads, III)
Director of Information

REPLY TO:

329 Windrose
El Paso, Texas 79912

hg

FOUNDED IN 1892

SIERRA CLUB »» Rio Grande Chapter
El Paso Regional Group
2809 N. Florence El Paso, Texas 79902

March 26, 1975

William K. Barker
District Manager
Bureau of Land Management
P.O. Box 1420
Las Cruces, N.M. 88001

Dear Mr. Barker:

The El Paso Regional Group of the Sierra Club considers the Las Uvas Planning Unit very important, both because of its location near to El Paso and because it contains some of the largest and unusually scenic roadless areas in this part of the country.

It is our feeling that the BLM has made a number of positive recommendations concerning the area, and we support the Bureau in its attempt to manage the area in a wise manner which will preserve the scenic areas for future generations.

The West Potrillo mountains are truly unique in this area of the country and should be protected by being named a Primitive Area. The Aden Lava Flow should be thoroughly studied and set aside as a research natural area. The Las Uvas Mountains have tremendous primitive and backcountry potential and should be managed accordingly.

We strongly urge that properly managed geothermal exploration be limited to the area east of the Mt. Riley area and outside of other natural and wildlife areas.

We support designation of specific use areas for ORVs which will not adversely affect primitive, natural, wildlife, watershed, and livestock values.

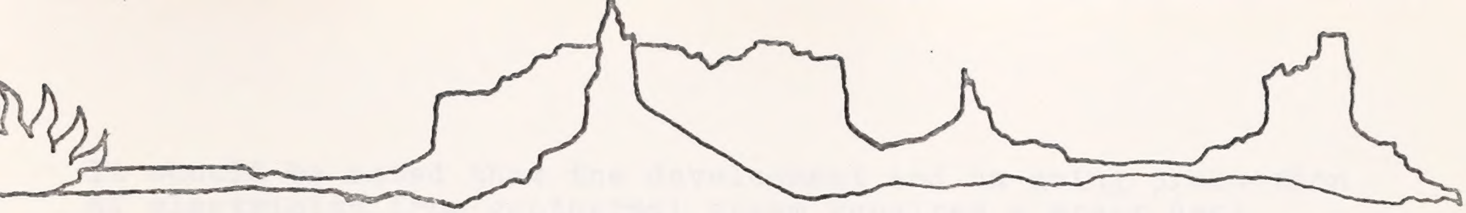
Thank you for your positive efforts to involve all parts of the community in your planning and decision making processes.

Sincerely,

George Mader

George Mader
Vice Chairman

. . . To explore, enjoy, and protect the nation's scenic resources . . .



THE RIO GRANDE CHAPTER OF THE SIERRA CLUB

Nan Nalder
924 Canyon Road #5
Santa Fe, New Mexico 87501

30 April 1975

Dennis Erhardt
Bureau of Land Management
Federal Building
Santa Fe, New Mexico

Dennis:

The following comments are in regard to the ENVIRONMENTAL ANALYSIS AND TECHNICAL REPORT ON PROPOSED GEOTHERMAL LEASING IN THE KILBOURNE HOLE AREA.

To begin with I wish to state that the report was very well written and for the most part the various geological areas were researched and recommendations to withhold certain of those areas: West Potrillos, Aden Lava Flow Study Area (I need a location map), were a good decision. I do feel, however, that certain other areas in the region should also have been removed at this time. These include:

1. The Kilbourne Hole, itself
2. The Las Uvas Mountains
3. Mt. Riley
4. Fort Mason
5. the blow sand area.

In addition to these I feel that nesting and habitat areas of endangered species mentioned in the report should be withheld, when possible, from the leasing program. While the recreational value of the above mentioned areas is great, I feel that special care should be exercised in not encouraging over-use of these primitive and scenic areas. In particular the ORV use of the above mentioned areas should be carefully reviewed and only specific areas should be accessed by the ORV crowd.

Geothermal leasing east of Mt. Riley and excluding the Aden Lava Flow, so long as planning, exploration, and development applications are very carefully reviewed and closely monitored by BLM does not seem objectionable at this time.

It should be noted that the development and on-going production of electricity from geothermal steam requires a great deal of water - much more than that amount used by fossil fuel plants. The water resources for the cooling towers and related plant use should be carefully studied and recommendations made concerning the number and placement of proposed development and production sites. The availability and quality of available surface and groundwater resources should be inventoried and carefully allocated among the various users - grazing tanks, domestic fresh water supply both locally existing and proposed users, geothermal plants, and other users in the district. The BLM and the various county and city planning commissions should carefully study the water needs of the area.

The placement and number of roads leading off into the various sites is an area which will demand a careful study so as not to encourage erosion and to protect the existing topography. BLM should require a new permit for each new road into the lease area and should carefully plot them so as to keep the number of roads to an absolute minimum.

As this is the first in a series of leasing programs to be monitored by the BLM, we think it wise to maintain a close watch on the development in the region. It would be interesting to review this development at set intervals in order to study how compatible the uses are.

Thank you for making available to us the analysis documnnt and for the opportunity to state our concerns.

Sincerely,

Nan Nalder

Geothermal Resources Study Project
Rio Grande Cahpter of the Sierra Club

March 26, 1975
ORVIL L ROBINSON
10504 Candlewood
EL Paso, TX 79925

US Dept of Interior
Bureau of Land Management
Las Cruces District Office
Las Cruces, New Mexico.

This addresses the proposed management plan for the Las Uvas planning Unit. I attended the public meeting, read the handout material and visited the Kilbourne Hole site. The Kilbourne Hole area is in every respect an Outstanding Natural area. The great value of this area as a resource for scenic splendor and scientific study makes it mandatory that the area be excluded from Geothermal leasing.

Orvil L Robinson

March 26, 1975
ORVIL L. ROBINSON
10504 Candlewood

US Dept of Interior
Bureau of Land Management
Las Cruces District Office.

This addresses the proposed management plan for the Las Uvas Planning Unit. I attended the meeting and read the material handed out. I visited the proposed West Potrillo Mtns primitive area. I found the area to be in virtual pristine condition for about 5 miles beyond the proposed boundary at nearly all points. Therefore your proposed boundaries should be enlarged.

Orvil L Robinson
EL PASO TX 79925

1880 Golden Drive
Las Cruces, NM - 88001

MAR 21

March twenty
1 9 7 5

Mr. William K. Barker, Dist. Mgr.,
Bureau of Land Management,
Las Cruces, NM - 88001
POB 1420

Dear Mr. Barker;

= I have attended three of the four public hearings held in Las Cruces by the Bureau of Land Management relative to the environmental impact of ORV, geothermal exploration and development, oil and gas exploration, mining, grazing, etc.

I am opposed to the exploitation of our natural resources by so-called "developers."

The area west of El Paso and south of Las Crcues known as the Las Uvas Planning Unit needs careful over-sight, planning supervision and protection.

The use of ORV should be severely restricted ~~in~~ when such use threatens the natural values of the area.

I endorse: a study of the West Portillos as a promitive area
a study of the Aden Lava Flow as suggested by BLM
protection of primitive and back-country value of Las Uvas Mountains
careful and restrictive management of geothermal areas
designation of specific areas for ORV use

Very truly yours,

Nelson Wurgler

Marianne Smith
10044 Suez Dr.
El Paso, TX 79925

MAR 21

DM
ADM
RM
PR
S

William K. Barker, District Manager
Bureau of Land Management
PO Box 1420
Las Cruces, NM 88001

Mr. Barker:

I strongly support protection of the Las Uvas Planning Unit in the following ways: I believe the Aden Lava Flow should be designated a research natural area; the West Potrillos should be studied for primitive area status: geothermal exploration should be limited to east of Mt. Riley in consideration of natural/wildlife areas - also, specific-use areas should be designated not only for geothermal exploration, but for Off-Road Vehicles, so the uniquely primitive, natural, and wildlife areas will not be adversely affected by the tremendous environmental impact these ORV's have.

I approve of the BLM's steps to preserve the environmental quality of the West Potrillos and the Las Uvas Planning Unit in general. This area has as yet been lightly impacted by man and should stay that way.

Sincerely,

Marianne Smith

Marianne Smith

Martha Bryant
1425 Monte Vista #4
Las Cruces, New Mexico

MAR 1 9

March 18, 1975

Mr. William K. Barker
District Manager
Bureau of Land Management
Box 1420
Las Cruces, New Mexico   88001

Dear Mr. Barker:

This letter is in support of the five following proposals:

(1) The study of the West Portillo Mountains for primitive area status.

(2) The designation of the Aden Lava Flow as a research natural area.

(3) The protection of the primitive and backcountry values of the Las Uvas Mountains.

(4) The properly managed geothermal exploration be limited to the area east of the Mt. Riley area and to areas outside of all other natural and wildlife areas.

(5) The support of the designation of specific use areas for ORV's which will not adversely affect primitive, natural, wildlife, watershed and livestock values.

I hope that this letter will be adequate for positive input to support the Bureau of Land Management in its management of these areas.

Sincerely,

Martha Bryant

Martha Bryant

MAR 19 75

4725 N. 70th St.
Scottsdale, Az. 85251
March 18, 1975

William K. Barker, District Manager
Las Cruces District Office
Bureau of Land Management
P.O. Box 1420.
Las Cruces, New Mexico 88001

Dear Mr. Barker:

Although I am a citizen of Arizona, I have taken an interest in the BLM lands of southern New Mexico. Following are my comments on the planning of the Las Uvas Planning Unit.

1) I support the study of the West Potrillo Mountains for Primitive Area designation. The West Portillos, besides being a rugged and scenic area, should be protected for their rare stands of healthy desert grasslands.

2) The Las Uvas Mountains also have substantial primitive and backcountry values which should be preserved. If Primitive Area status is not possible for this area, some other form of protective designation should be considered.

3) Designation of the Aden Lava Flow as a Research Natural Area would be a wise and highly beneficial move.

4) Geothermal exploration should be limited to those areas which do not contain outstanding wildlife or natural values (such as the area east of Mt. Riley). Exploration should be carefully managed to minimize any resultant damage.

5) Small parcels of already-disturbed land should be set aside specifically for ORV use, and the rest of the planning unit should be closed to off-road travel. ORV use must not be allowed to conflict with natural, primitive, wildlife, watershed, or livestock values.

Thank you for this opportunity to comment on the management of our public lands.

Sincerely,

Tom Wright

Tom Wright

BLM

MAR 19 1975

March 18, 1975

Mr. William K. Barker
District Manager
Bureau of Land Management
P.O. Box 1420
Las Cruces, N.M.

Dear Mr. Barker:

I am writing with reference to the plans your agency is developing for the Las Uvas area. Having an interest in the preservation of as much area around Las Cruces for recreation as possible, I would like to support the following specific concerns:

1. That the West Potrillo mountains be thoroughly studied for possible inclusion as a primitive area
2. That the Aden Lava Flow be designated as a Research Natural Area
3. That the Las Uvas Mountains be protected for their primitive and back-country value.
4. That any geothermal development be limited to the area east of Mount Riley and be carefully supervised to prevent adverse impact on the area.

I hope the planning stage is going well and hope to attend some future meetings dealing with this area.

Sincerely yours,

Steve C. Ropp

LAS UVAS PLANNING UNIT

PUBLIC PARTICIPATION SHEET

RESOURCE ACTIVITY Minerals

RECOMMENDATION NO.

COMMENTS Am in favor of reasonable Geothermal, Oil, Springs, Water, Gas, by City & County and other Groups—

④ Am not in favor — also ⑥

(Conflicts)

② not in favor —

③ (Recreation)

C - Am in favor

d " " "

(Timber + other Vegetative Products)

① in favor

② " "

Signature

March 12-75
Date

CRUCES
MAR 19
DM

March 19, 1975

1501 N. Oregon #3
El Paso, Texas 79902

W. K. Barker
Area Manager
Bureau of Land Management
P.O. Box 1420
Las Cruces, New Mexico 88001

Dear Mr. Barker:

Thank you very much for your letter of March 14. When I wrote I did not realize that the entire 300 page EAR concerned geothermal leasing. I have contacted Mrs. Dodds of the Sierra Club, and although I have not yet had the opportunity to study the EAR in depth, she has promised to loan it to me before she returns it. Thank you for your helpful suggestion.

I am very pleased to note from your letter that the West Potrillo Mountains are to be studied for primitive designation and that surface occupancy on the Aden Lava Flow is being witheld prior to intensively studying the area.

I still am of the personal opinion that an EIS is in order in accordance with NEPA, but of course this is only my opinion. I also am very acutely aware that you and the members of your team are the most cooperative Federal Administrators that regional conservationists deal with, and I hope you won't take my beliefs on the EIS question personally.

Once again, thank you for your efforts to take a balanced view in the development of this really unique area.

Sincerely,

Paul Garland

H. Paul Garland

March 10, 1975

MAR 13 '75

Hadley Paul Garland
1501 N. Oregon #3
El Paso, Texas 79902

Bureau of Land Management
P.O. Box 1420
Las Cruces, New Mexico 88001

Dear Mr. Barker:

This letter is in response to the Management Framework Plan, Las Uvas Planning Unit.

In general I would like to complement you on your efforts to formulate a well balanced plan which accomodates all interests. I do have several specific suggestions and comments, however.

I would very much like to see the West Potrillo mountains protected from development and destruction. I would hope that your agency would adopt some sort of program which will prevent roads being constucted in currently roadless areas, and officially wait to begin leasing in the area for geothermal use until the areas nearby to the East are actually producing electricity and a study is completed on the actual environmental consequences.

I would like to see the Aden Lava Flow protected as a research natural area.

Although most of the floor of Kilbourne's Hole is private property, the BLM land immediately adjacent should receive some sort of administrative classification which will preserve this highly unique feature. I do not wish to end all geothermal leasing in the area, however, I would like to see the actual hole itself protected from dstruction.

In my opinion the BLM will be breaking the law if it begins geothermal leasing in the area without filing an Environmental Impact Statement. In accordance with the National Environmental Policy Act (NEPA) an EIS must be prepared by the responsible federal agency in every case when there is a potential that the environment may be significantly affected by a federal action. Although there are no hard and fast rules as to how large a project must be to trigger the NEPA requirements, injunctions have been issued concerning improvements of a few miles of road, the construction of astudent dorm, and small timber sales in National Forest Roadless Areas. I feel that the cummulative impact from this leasing and successive implementation of similar actions certainly falls within the guidelines set out in NEPA.

At the recent public meeting concerning the environmental aspects of the Management Framework Plan for the Las Uvas planning unit you stated that in your opinion an EIS was not required but that if any member of the public wished to inspect the environmental assessment it would be available for inspection in Las Cruces or that you would copy it at the public's expense. Since it is my opinion that the leasing will be breaking the law and may subject you to possible legal action, before any real action is taken I would like to inspect the portion of the environmental assessment pertaining to the geothermal leasing. Since I feel that it is your duty to provide this and since I live in El Paso and am not able to spend the time in Las Cruces to properly inspect this document, I ask that you copy all portions of the environmental assessment pertaining to geothermal leasing, at your expense, and mail it to me. It may well be that once environmentalists in the Southwest inspect your analysis we will agree with you that an EIS is not in order. However, until we do inspect your analysis in this portion of the planning process our assumption has to be that your actions are illegal.

Once again let me thank you for your sincere efforts to include all interested sections of the community in your planning and decision making processes.

Sincerely,

HADLEY PAUL GARLAND

HEALTH SAFETY WELLBEING COMFORT

STATE OF NEW MEXICO

Environmental
Improvement
Agency

1001 North Solano Drive
Las Cruces, New Mexico 88001
Phone (505) 523-4513

MAR 13 '75

March 12, 1975

Mr. Gary McVickers
Bureau of Land Management
P. O. Box 1420
Las Cruces, New Mexico 88001

Dear Mr. McVickers:

We are submitting these comments as a result of the public meetings regarding the planning for the Las Uvas Planning Unit.

1 - The varied vegetation which is planned for the border of stock tanks and flood control structures provides an excellent breeding habitat for various species of mosquitoes which can transmit disease to man and livestock. They will also feed on wild birds and game animals. We would recommend that the top feeding mosquito fish Gambusia Affinis be stocked in these areas whenever they hold water.

2 - The problem of providing sanitary landfill sites for the population centers is a real and never-ending problem. We would support having some areas set aside for this purpose in the Anapra, Santa Teresa Subdivision and Las Cruces areas.

3 - We would also support the idea of trading off public lands for residential and industrial uses on the west mesa because the high water table in the valley precludes individual liquid waste disposal systems in many areas. The combination of all disposal systems that are present in the valley constitute a source of ground water contamination.

4 - The organized off road races will cause a large number of automobiles to be in one location. This will cause elevated carbon monoxide and other emission levels. The dust generated on dirt roads also adds to the particulate matter load in the air.

5 - The potential geothermal energy production in the area could cause some water pollution problems if saline waste water is to be discarded. The E.I.A. requires dischargers of over 2,000 gal./day to submit plans for approval.

Sincerely,

Charles Hendrickson

Charles Hendrickson
Supervising Environmentalist

CH:mlg

MAR 12

March 10

Mr Bill Barker
Bureau of Land Management
Las Cruces, N.M.

Dear Bill,

The following are my comments on the Management framework Plan. First I would like to compliment you on it's thoroughness. It adreses the conflicts and environmental impacts of all proposals, more completely, and with more fairness than any other statements I've read.

1. On the Lands section I feel that disposing of lands near urban areas for expansion encourages urban sprawl, and this should be addused as a conflict

2. On minerals section - While I realize that it may well be impossible to control, I hate to think of geothermal exploration taking place every where there is a lease application. At any rate those areas with natural or primitive potential, should be the last to go.

(Las Uvas & West Portrillos)

Regarding Rec. 3 in Minerals — certain areas within the unit should be open for the extraction of sand, gravel etc., but by no means should indiscriminant use be allowed through out the unit.

Rec 4 - c & d — The conflicts with these areas should be resolved in favor of their natural & primitive values.

On Timber Section - This is the first of several mentions of herbicide (24D) and I strongly object to this. Not only does it completely defoliate (more than just the mosquite) but many athorities disagree on the saftey of 24D. This same feeling goes for Rec. 4 & 5 & 6 under Livestock forage, and similar rec. in Wildlif & watershed.

Also under Livestock Forage section — Rec 13 — perhaps an alternate plan of controlled burns during wet season in off years of rest-rotation plan.

In Recreation section —

Rec 1 - I believe that a conflict does exist for this — mainly increased signs et will encourage more use. Not all areas

need or can sustain heavy use.

The same applies to Rec 2, and could lead to vandalism and destruction in the case of archeological & historic sites.

Rec 7- While I support the establishment of ORV areas, the conflicts listed sound formidibible, and there is already an established area near Las Cruces (Organ Mt Unit)

Rec 14- The rational of it being a Falcon area seems more of a conflict.

Rec 16- Once again the conflicts with ORV use seem over whelming.

Rec 17- Seems justifiable & desirable.

Rec 18- The conflicts do not seem to be valid in merely studying the area (a study would seem to assist & resolve the conflicts)

On Wildlife Section— Rec 2- Once again the study seems a feasible means of resolving any but short term conflicts

All other recommendations I have no specific comments on.

Sincerely
Debbie Seace

The Wilderness Society 4260 E. Evans Avenue, Denver, Colorado 80222
Western Regional Office Phone (303) 758-2266

March 10, 1975

MAR 12 '75

Mr. W.K. Barker
District Manager
Bureau of Land Management
PO Box 1420
Las Cruces, NM 88001

Dear Bill

I would like to offer the following comments on the Management Framework Plan for the Las Uvas Planning Unit. As usual, you and your staff have done a very thorough and complete job and the recommendations indicate your sincere interest in the wise and long-term management of the public lands.

To begin with, I certainly recognize the value and importance of livestock grazing in the Las Uvas Unit, as well as the need for geothermal and oil & gas exploration. Although ORV use can be highly detrimental to forage, watershed, land, other recreation uses, wildlife, and primitive and natural values, I realize that there is a need to locate areas for ORV's - though preferably where they will be less damaging.

Other than my general interest in the wise management and use of the land, my major concern in the Las Uvas Unit is the protection of primitive, natural, and backcountry values. I believe that this planning unit has some of the more significant such values of anywhere in New Mexico.

I will comment on each of the resource categories in the order in which they appear in the information packet.

LANDS

I am concerned with Recommendation 1 since it seems to encourage urban sprawl. BLM management of these lands prevents this sprawl and provides needed open space on the edges of the urban areas. I therefore recommend that these lands remain in BLM ownership.

Rec 2 I can support since the lands to be acquired will be of more importance than those selected. I have no objection to Rec 4 since these seem to be reasonable uses. 5, 6, 7, & 8 are also good.

MINERALS

Rec 1 - not all lands should remain open for geothermal purposes. Where more important values are present such as the West Potrillos, Aden Lava Flow, Las Uvas Mountains, and along the Rio Grande, these values should be considered. Only if definite evidence points to highly significant geothermal potential should exploitation be allowed.

Rec 2 - because of above, I am opposed entirely to this.

Rec 3 - park areas, blow sand areas, Ft Mason, West Potrillos, Las Uvas Mountains, Aden Lava Flow, waterfowl habitat along the Rio Grande should all be withdrawn from this use.

Rec 4 - only the presently mined cinder cone in the southern West Portillos and cones

"In Wildness is the Preservation of the World." - Thoreau

in the Aden area which would not infringe on undeveloped portions of the West Potrillos should be open for mineral extraction. The Aden Lava Flow, blow sand areas, and zone-tailed hawk nesting sites should also be closed.

Rec 5 - my comments on Minerals Rec 1 apply here also.

Rec 7 is good.

TIMBER

Rec 1 & 2 - sale and gathering of yucca and cactus should be allowed only in areas where there will be no conflicts with other values and only where their occurrence will not be drastically thinned.

FORAGE

In general, management should strive toward establishing proper livestock numbers on the land - the range should be vigorous and healthy and erosion prevented.

Rec 4 - mesquite spraying should not occur. We are not opposed to vegetative manipulation where wildlife and natural values will not be harmed and when natural grassland is being restored, but are opposed to herbicides to do this. Alternate methods should be found.

Please send me the DEIS on mesquite spraying.

Rec 5 - resolve in favor of conflicts 1 & 2.

Rec 6 - will this involve herbicides?

Rec 7, 8, 10, & 11 - good.

Rec 13 - An effort should be made to restore the natural grassland fire ecology.

WATERSHED

Rec 1 - ok to root plow creosote; no for herbicides on mesquite. This should also be resolved in favor of all conflicts.

Rec 2, 3, 5, & 6 - good.

RECREATION

Rec 1 & 2 - care should be taken to prevent publicizing areas which would suffer under excessive use (such as West Potrillos, etc.).

Rec 3, 5, & 6 - good.

Rec 4 - OK as long as game populations do not become unnaturally high.

Rec 7 - resolve in favor of conflicts.

Rec 8 - resolve in favor of protecting backcountry & primitive values.

Rec 9 - no.

Rec 10 - good.

Rec 11 & 12 - good.

Rec 14 - I'm concerned that there may be a conflict with the falcon wintering area.

Rec 15 - resolve in favor of the conflicts.

Rec 16 - no. Kilbourne Hole is an outstanding wildlife and natural area.

Rec 17 - OK.

Rec 18 - Every step should be taken to preserve the backcountry primitive values of the Las Uvas Mountains. Conflicts should be resolved towards this protection.

Rec 19 - Yes. We will further study this area also and report our findings to you. Geothermal leasing should be kept out of this area at the present time. We do not object to geothermal leasing east of Mt. Riley, excluding the Aden Lava Flow.

Rec 20 - OK.

WILDLIFE

Rec 2 - Very good. Conflicts should be resolved in favor of the outstanding natural values present.

Rec 3 & 4 - care should be taken that unnaturally large wildlife populations do not occur. Are the West Potrillos historic pronghorn range?

Rec 5, 6, 7,8, 9,10, 11, 12, 13, 14, - good.

Rec 15 - herbicides should not be used for any vegetative treatment.

Rec 16, 17, 19, 20, 21,22,23,24,25,26,27 - good.

I hope these comments will be useful. I will plan to offer more detailed recommendations in specific areas as the planning process advances.

I especially support study of the West Potrillos for primitive area status, designation of the Aden Lava Flow as a research natural area, protection of the primitive and back-country values of the Las Uvas Mountains, properly managed geothermal exploration east of the Mt Riley area and outside of other natural and wildlife areas, designation of use areas for ORV's that will not adversely affect primitive, natural, wildlife, water-shed, and livestock values.

Would you please send me a map showing the tentative boundaries for the West Potrillo study area and the Aden Lava Flow RNA (or the sections included)?

Sincerely

Dave Foreman
Field Representative
The Wilderness Society

cc: Wes Leonard

MAR 12 '75

LAS UVAS PLANNING UNIT

PUBLIC PARTICIPATION SHEET

GENERAL COMMENT:

I am too much of a newcomer to this area, having only moved here in October 1974, to comment adequately on any of the specific recommendations. However, I do want to express my views as they apply to the whole package of proposals.

As is the case with all such multiple-use plans for development, a "trade-off" must be accomplished between the needs and desires of the various vested interest groups in order for any action to be taken. But it seems to me that such an accomodation can be made for the Las Uvas planning Unit with a minimum of conflict if the several expressed priorities are brought into balance. For example, national needs call for an intensive effort in the areas of geothermal and mineralogical resource development. These matters also deserve consideration in New Mexico. But at the same time, those recommendations of the study that are in conflict with such development by calling for the preservation of certain wildlife habitats and for the creation of some primitive areas do not encompass all of the areas needed for geothermal and mineralogical development. Could it not be possible to set aside habitat and primitive areas and still have ample acreage left for geothermal and mineralogical leases?

My recommendation is twofold in nature. First, in those cases where "people needs"(those of the general public, to include the preservation of wildlife and primitive areas) can be satisfied without the total elimination of commercial needs, the needs of the people should be given primary consideration. Second, in those cases where the sacrifice of commercial development and use appears to be too severe at this time, I suggest that action be delayed until such time that further study be completed.

I recognize that in order for our economic welfare to be sustained or improved that some sacrifice of our natural heritage will have to be made. But I urge that such sacrifice be made in a most cautious manner. It should have become apparent to all of us by now how difficult it is to try to re-establish natural conditions once they have been destroyed. New Mexico and its people are in an enviable position in that they still have a choice. My only hope is that they choose wisely.

Ronald A. Smith

Ronald A. Smith
950 Laurel Street
Las Cruces, N.M.

Bureau of Land Management
Library
Denver Service Center

ER'S CARD

ysis and
on

	OFFICE	DATE RETURNED

(Continued on reverse)